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Canada. [Boundary commissions]

Manitoba - Saskatchewan boundary commission.

Report - - -

Commissioners

R. THISTLETHWAITE, D.L.S., A.L.S., B.C.L.S.,
for the Government of Canada

E. GAUER, D.L.S., M.L.S.,
for the Government of Manitoba

A. I. BERESKIN, D.L.S., S.L.S.,
for the Government of Saskatchewan

Report of the Commission
Appointed to Demarcate the Boundary
between the Province of Manitoba and
the Province of Saskatchewan.

PART I
1961 - 1962
Latitude $56^{\circ}20'$ - $60^{\circ}00'$

Manitoba - Saskatchewan Boundary Commission

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OTTAWA, ONTARIO, AUGUST 2, 1965


TO THE HONOURABLE J. WATSON MACNAUGHT, P.C., Q.C., M.P., MINISTER OF MINES AND TECHNICAL SURVEYS, OTTAWA, CANADA; THE HONOURABLE STERLING R. LYON, Q.C., M.L.A., MINISTER OF MINES AND NATURAL RESOURCES, WINNIPEG, MANITOBA; THE HONOURABLE J. M. CUELENAERE, Q.C., M.L.A., MINISTER OF NATURAL RESOURCES, REGINA, SASKATCHEWAN.

Your Commissioners, R. Thistlethwaite, D.L.S., A.L.S., B.C.L.S., representing the Government of Canada, E. Gauer, D.L.S., M.L.S., representing the Government of Manitoba and A. I. Bereskin, D.L.S., S.L.S., representing the Government of Saskatchewan, have the honour to submit the following report on the survey of that portion of the second meridian which constitutes the defined boundary between the Provinces of Manitoba and Saskatchewan, North of Township 84.

The survey was made by L. E. Boutilier, M.L.S., during the years 1961 and 1962.

An atlas of 15 map sheets, covering the portion of the boundary surveyed in 1961 and 1962, accompanies and forms part of this report.

R. THISTLETHWAITE,	}	<i>Commissioners</i>
E. GAUER,		
A. I. BERESKIN.		

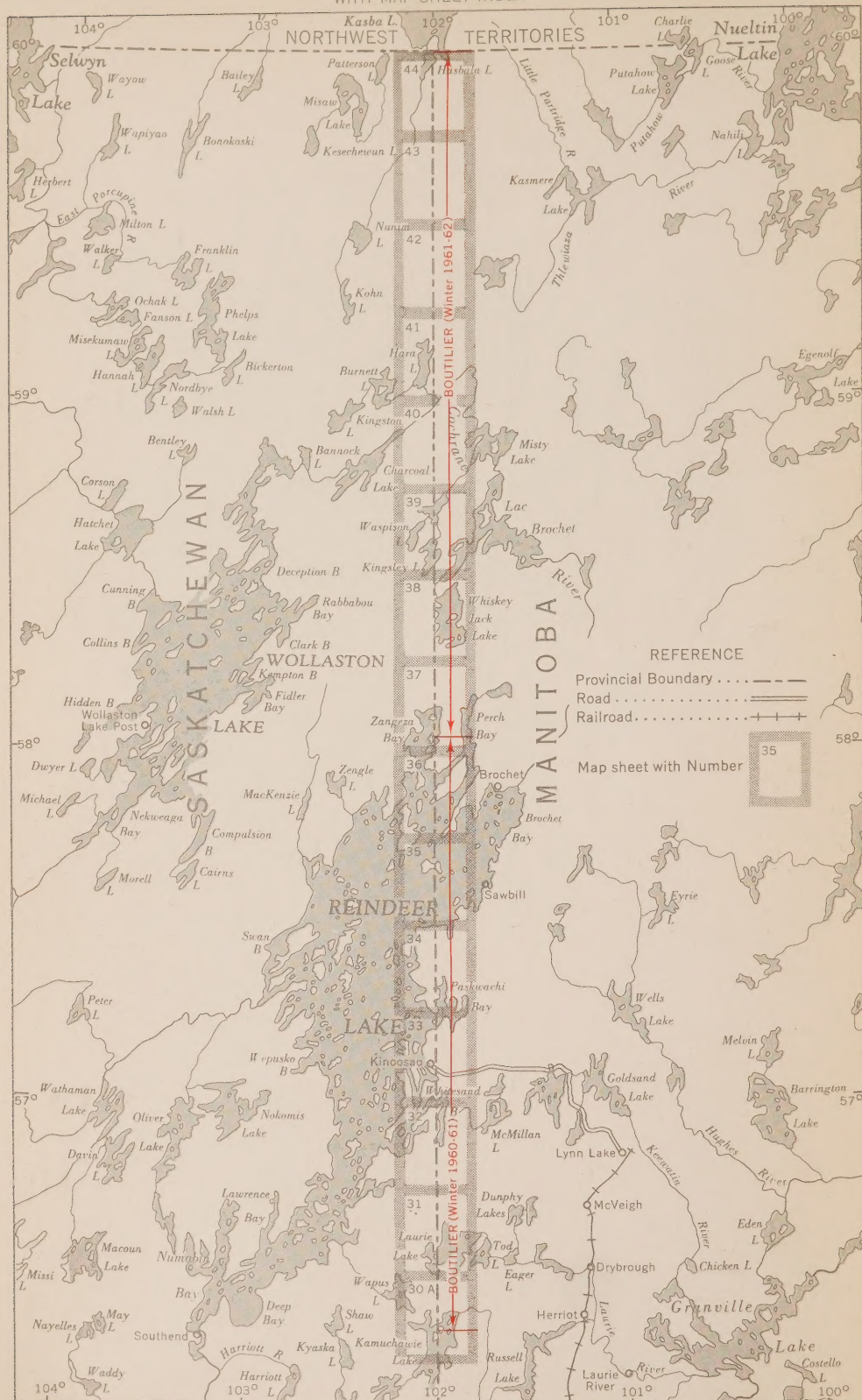


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KEY MAP

SHOWING PROGRESS BY SEASONS
WITH MAP SHEET INDEX



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CHAPTER I

INTRODUCTION

STATUTORY DESCRIPTION OF BOUNDARY

Manitoba became a province of Canada on July 15, 1870. Its boundaries were defined in The Manitoba Act, 33 Victoria, Chapter 3 and the province comprised the territory lying between 96° and 99° west longitude and between parallels of 49° and $50^{\circ}30'$ north latitude.

In 1881, the boundaries of Manitoba were extended and were defined in an Act to provide for the extension of the Province of Manitoba—44 Victoria, Chapter 14—which reads as follows:

“1. The Province of Manitoba shall be increased as hereinafter defined, that is to say, so that the boundaries thereof shall be as follows: Commencing at the intersection of the International Boundary dividing Canada from the United States of America by the centre of the road allowance between the twenty-ninth and thirtieth ranges of townships lying west of the first principal meridian in the system of Dominion Land Surveys; thence northerly following upon the said centre of the said road allowance as the same is or may hereafter be located, defining the said range line on the ground across Townships one to forty-four, both inclusive, to the intersection of the said centre of the said road allowance by the centre of the road allowance on the twelfth base line in the said system of Dominion Land Surveys; thence easterly along the said centre of the road allowance on the twelfth base line, following the same to its intersection by the easterly limit of the District of Keewatin as defined by the Act thirty-ninth Victoria, Chapter twenty-one, that is to say, to a point where the said centre of the road allowance on the twelfth base line would be intersected by a line drawn due north from where the westerly boundary of the Province of Ontario, intersects the aforesaid International Boundary Line dividing Canada from the United States of America; thence due south following upon the said line to the International Boundary aforesaid, and thence westerly, following the said International Boundary Line dividing Canada from the United States of America to the place of beginning, and all the land embraced by the said description not now within the Province of Manitoba, shall, from and after the passing of this Act be added thereto, and the whole shall, from and after the said date, form and be the Province of Manitoba.”

Saskatchewan became a province on September 1, 1905. When its eastern boundary was defined in the Saskatchewan Act of 1905, the west boundary of Manitoba, as defined in 1881, was adopted and was extended northerly to the sixtieth degree of north latitude.

The complete boundary between the two provinces is defined by section two of the Saskatchewan Act, 4-5 Edward VII, Chapter 42, which reads as follows:

“2. The territory comprised within the following boundaries, that is to say, commencing at the intersection of the international boundary dividing Canada from the United States of America by the west boundary of the province of Manitoba, thence

northerly along the said west boundary of the province of Manitoba to the northwest corner of the said province of Manitoba; thence continuing northerly along the centre of the road allowance between the twenty-ninth and thirtieth ranges west of the principal meridian in the system of Dominion lands surveys, as the said road allowance may hereafter be defined in accordance with the said system, to the second meridian in the said system of Dominion lands surveys, as the same may hereafter be defined in accordance with the said system; thence northerly along the said second meridian to the sixtieth degree of north latitude; thence westerly along the parallel of the sixtieth degree of north latitude to the fourth meridian in the said system of Dominion lands surveys, as the same may be hereafter defined in accordance with the said system; thence southerly along the said fourth meridian to the said international boundary dividing Canada from the United States of America; thence easterly along the said international boundary to the point of commencement, is hereby established as a province of the Dominion of Canada, to be called and known as the province of Saskatchewan."

In 1912 Manitoba's boundaries were again extended. The Manitoba Boundaries Extension Act, 2 George V, Chapter 32, Section 3, declared that more territory was to be added to the province and that the boundaries were to be as follows:

"3. The limits of the province are hereby increased so that the boundaries of the province shall be as follows: Commencing where the sixtieth parallel of north latitude intersects the western shore of Hudson Bay; thence westerly along the said parallel of latitude to the northeast corner of the province of Saskatchewan; thence southerly along the easterly boundary of the province of Saskatchewan to the international boundary dividing Canada from the United States; then easterly; and all the land embraced by the said description not now within the province of Manitoba shall, from and after the commencement of this Act, be added thereto and the whole shall, from and after the said commencement, form and be the province of Manitoba."

The Acts quoted above clearly define the common boundary between the provinces of Manitoba and Saskatchewan.

ESTABLISHMENT OF COMMISSION

The natural resources were transferred from the Dominion to Manitoba on July 15, 1930 and to Saskatchewan on March 11, 1931.

Prior to these dates the respective natural resources had been developed and administered by the federal government and the definition on the ground of the boundary between the two provinces was not an important consideration.

After the transfer, however, the situation changed completely and the definition of the boundary on the ground became essential for the proper administration of the resources.

The situation was particularly pressing at Flin Flon where the large orebody and some of the mine buildings of the Hudson Bay Mining and Smelting Company were astride the boundary. The Company made strong representations to both provincial governments to have the boundary at Flin Flon clearly defined on the ground.

In the statutory descriptions given earlier in this chapter, reference is made to the Dominion Lands survey system by which the boundary is to be defined. For about two-thirds of its length, the boundary is described as the centre of the

road allowance between ranges 29 and 30 west of the principal meridian and for the remainder, the boundary is the second meridian.

The actual position of the boundary for some 500 miles is therefore dependent on the position of the range line between ranges 29 and 30 which defines the road allowance. The position of the boundary is therefore located from the survey monuments placed at the section and quarter-section corners on the east boundary of range 30.

Before the transfer of the natural resources, a large portion of this range line had been surveyed under the Dominion Lands survey system, under instructions from the Surveyor General of Canada.

In considering the establishment of a boundary commission to carry out the necessary boundary surveys, the two provincial boundary commissioners felt that the Surveyor General of Canada should be appointed as a third member of the commission.

Requests were made by both provincial governments to the federal government for the appointment of these three officials to the commission.

Federal Order in Council, P.C. 1410, dated June 10, 1936 established the Manitoba-Saskatchewan Boundary Commission and granted authority to complete the definition by survey on the ground of the boundary between Manitoba and Saskatchewan. Copy of this and subsequent orders in council by which the members of the Commission at various times were appointed and which set out the functions of the Commission and the agreed division of the costs of the surveys are given hereunder.

Copy of a Minute of a Meeting of the Committee of the Privy Council, approved by His Excellency the Governor General on the 10th June, 1936.

P.C. 1410

The Committee of the Privy Council have had before them a report, dated 2nd June, 1936, from the Minister of the Interior, submitting as follows:

Under the terms of an Act to provide for the extension of the boundaries of the Province of Manitoba of 1881 and of the Saskatchewan Act of 1905, the boundary between Manitoba and Saskatchewan is fixed by lines in the system of Dominion Lands Surveys.

Prior to 1930, when the lands on both sides of it were Dominion Lands, certain portions of the boundary had been surveyed and other portions had not been surveyed;

Both the Province of Manitoba and the Province of Saskatchewan have now made representations to the Minister of the Interior that the completion of the survey of the boundary is necessary for purposes of administration, and have requested that the Surveyor General of Dominion Lands be appointed as Chairman of a Commission of three persons empowered to take action to complete the necessary surveys, subject to the approval and acceptance by the Legislatures of both provinces;

The Province of Manitoba and the Province of Saskatchewan respectively have passed Orders in Council appointing S. E. McColl, Director of Surveys, for Manitoba, and M. B. Weekes, Controller of Surveys for Saskatchewan, as the two other members of the Commission.

The Committee, therefore, on the recommendation of the Minister of the Interior, advise that Frederic H. Peters, Surveyor General of Dominion Lands, be hereby appointed, in accordance with the request of the Provinces of Manitoba and Saskatchewan, to act as Chairman of a Commission consisting of S. E. McColl, Director of Surveys for Manitoba,

and M. B. Weekes, Controller of Surveys for Saskatchewan, and the said F. H. Peters, which Commission shall have and exercise all necessary authority to issue instructions for, and direct the execution of all surveys, including the employment of all professional and other personnel, and the purchase of necessary equipment and supplies, as may be necessary to complete the definition by survey on the ground of the boundary between Manitoba and Saskatchewan, in accordance with the provisions of the Act to provide for the extension of the boundaries of the Province of Manitoba of 1881, and the Saskatchewan Act of 1905, subject to approval and acceptance by the Legislatures of both provinces.

The Committee further advise that the Dominion Government shall only be responsible for the expenses of the said F. H. Peters, and shall not be responsible for any other expenses of the Commission, or of the surveys executed under its instruction and direction.

E. S. LEMAIRE,
Clerk of the Privy Council.

Copy of a Minute of a Meeting of the Committee of the Privy Council, approved by His Excellency the Governor General on the 9th July, 1941.

P.C. 5041

The Committee of the Privy Council have had before them a report, dated 25th June, 1941, from the Minister of Mines and Resources, submitting as follows:—

By Order in Council P.C. 1410 dated June 10th, 1936, a Commission was appointed to fix by survey certain sections of the Boundary line between the Provinces of Manitoba and Saskatchewan, the said Commission consisting of F. H. Peters, Surveyor General of Dominion Lands, S. E. McColl, Director of Surveys, for Manitoba, and M. B. Weekes, Controller of Surveys, for Saskatchewan, and which Commission was authorized to issue instructions for, and direct the execution of all necessary surveys including employment of personnel, and the purchase of necessary equipment and supplies as was necessary to undertake the said Boundary survey work.

Further boundary delineation work is now urgently necessary, and the Province of Manitoba has appointed by Order in Council, H. E. Beresford, Director of Surveys (vice S. E. McColl, deceased), and the Province of Saskatchewan has appointed by Order in Council, D. A. Smith, Controller of Surveys (vice M. B. Weekes, retired) as their respective representatives.

Vote 493 of the further Supplementary Estimates 1941-42, Surveys and Engineering Branch, Department of Mines and Resources, provides for a Dominion contribution of One Thousand Dollars (\$1,000.00) towards the cost of extending the survey of the boundary between Manitoba and Saskatchewan, with the Provinces concerned to bear two-thirds of the total cost.

The Committee, therefore, on the recommendation of the Minister of Mines and Resources, advise that the establishment of the Manitoba-Saskatchewan Boundary Commission be hereby confirmed, and that the following be hereby appointed thereto:—

F. H. Peters, Surveyor General of Dominion Lands, representing the Dominion.
H. E. Beresford, Director of Surveys, Manitoba, and
D. A. Smith, Controller of Surveys, Saskatchewan.

the first named to be Chairman; the said Commission to have the authority and power to act in accordance with the said P.C. 1410 dated June 10th, 1936,—the boundary as delineated being subject to the approval and acceptance by the Legislatures of both Provinces, and the Dominion to bear one-third of the cost of the said work up to a total of One Thousand Dollars (\$1,000.00) as provided under Vote 493.

A. D. P. HEENEY,
Clerk of the Privy Council.

Due to the extension of the railway to Lynn Lake in northern Manitoba in 1953, more intensive prospecting was taking place on both sides of the boundary in that area. In 1957, encouraging finds of minerals were made on the Saskatchewan side of the boundary and the matter of jurisdiction over commercial fishing interests in Reindeer Lake through which the boundary runs was giving concern to officials of both governments. For these and other reasons, the responsible ministers of the two provincial governments requested the federal minister to have the Commission re-activated for the purpose of proceeding with the survey of the second meridian portion of the boundary. This was done as evidenced by the following Order in Council.

Copy of a Minute of a Meeting of the Committee of the Privy Council, approved by His Excellency the Governor General on the 2nd January, 1958.

P.C. 1958-9

The Committee of the Privy Council, on the recommendation of the Minister of Mines and Technical Surveys, advise that the portion of the Second Meridian which constitutes the defined boundary between the Provinces of Manitoba and Saskatchewan which remains as yet unmarked on the ground be now surveyed and so marked.

The Committee further advise

1. That Robert Thistlethwaite, present Surveyor General of Canada Lands, be appointed to the Commission constituted by Order in Council P.C. 1410 of 10th June, 1936, to complete the definition by survey on the ground of the boundary between the Provinces of Manitoba and Saskatchewan (which Commission was confirmed by Order in Council P.C. 5041 of 9th July, 1941) and be designated as Chairman thereof;
2. That H. E. Beresford, Director of Surveys, Manitoba, and A. I. Bereskin, Controller of Surveys, Saskatchewan, be confirmed as representatives of the said Provinces on the Commission; and
3. That the costs of the work to be undertaken by the said Commission be shared equally by the Governments of Canada, Manitoba and Saskatchewan.

R. B. BRYCE.

Clerk of the Privy Council.

Copy of a Minute of a Meeting of the Committee of the Privy Council, approved by His Excellency the Governor General on the 2nd of May, 1963.

P.C. 1963-683

The Committee of the Privy Council have had before them a report dated 1st April 1963, from the Minister of Mines and Technical Surveys, submitting:

That Order in Council P.C. 1410 of 10th June, 1936, authorized the establishment of the Manitoba-Saskatchewan Boundary Commission to complete the definition by survey on the ground of the boundary between the Provinces of Manitoba and Saskatchewan, in accordance with the provisions of an Act to provide for the extension of the boundaries of the Province of Manitoba, chapter 14 of the Statutes of Canada, 1881 and the Saskatchewan Act of 1905, 4-5 Edward VII, chapter 42;

That many changes have been made in the composition of the Commission, which has not yet completed the work with regard to the portion of the Second Meridian that constitutes the defined boundary between the Provinces of Manitoba and Saskatchewan;

That it is desirable that a new Commission, having the same powers and authority as enjoyed by the Commission above referred to, be established to complete the said work and to report thereon.

The Committee, therefore, on the recommendation of the Minister of Mines and Technical Surveys, advise that a new Manitoba-Saskatchewan Boundary Commission be established to continue the work begun by the Commission established by Order in Council P.C. 1410 dated June 10, 1936, to consist of the persons hereinafter named:

R. Thistlethwaite, Esquire,

Surveyor General of Canada, who shall be Chairman

Edward Gauer, Esquire,

Director of Surveys, Department of Mines and Natural
Resources, Province of Manitoba,

A. I. Bereskin, Esquire,

Controller of Surveys, Department of Natural Resources,
Province of Saskatchewan.

The Committee further advise

1. That the said new Commission be empowered to issue instructions for, and direct the execution of all surveys, including the employment of all professional and other personnel, and the purchase of necessary equipment and supplies, as may be necessary to complete the definition by survey on the ground of that portion of the Second Meridian which constitutes the defined boundary between the Provinces of Manitoba and Saskatchewan, in accordance with the Saskatchewan Act of 1905, 4-5 Edward VII, chapter 42 and The Manitoba Boundaries Extension Act, 1912, 2 George V, chapter 32, and to accept in its discretion previous fixations of boundary points where the points are of the desired accuracy;
2. That a report of the said survey be submitted by the said Commission to the Parliament of Canada and the Legislatures of the Provinces of Manitoba and Saskatchewan;
3. That the costs of the work to be undertaken by the said Commission be shared equally by the Government of Canada, the Government of the Province of Manitoba and the Government of the Province of Saskatchewan, the costs to be incurred by Canada to be chargeable to appropriations to be provided.

R. B. BRYCE,

Clerk of the Privy Council.

Portions of the boundary were surveyed under the direction of the Commission in 1936, 1941 and 1947, and a summary of these surveys is given in Appendix III.

PREPARATORY ARRANGEMENTS BY COMMISSION

Following the re-activation of the Commission by Order in Council P.C. 1958-9, dated January 2, 1958, the Commission held meetings on January 27 and July 29 that same year, and a decision was made on the starting point of the survey.

By subsequent correspondence between the Commissioners, it was decided to proceed with the survey during the winter of 1960-61. One of the main considerations in deciding on a winter survey was the ease with which the various water bodies on the boundary could be crossed on a winter survey as compared to a summer survey. This and other factors such as better chainage over muskeg and

increased mobility tend to assure greater efficiency in certain survey operations. A further consideration was that winter employment would be provided for a number of men.

At a meeting of the Commission on June 30, 1960, it was agreed to place the organization and administration of the field project with A. I. Bereskin, the Saskatchewan Commissioner who was also delegated to prepare the instructions for the survey and submit them to the other two Commissioners for their approval.

At this meeting, the matter of selecting a party chief was given careful consideration. Various names of surveyors for the position were submitted by the respective Commissioners and it was finally decided that L. E. Boutilier, M.L.S., a member of the staff of the Surveys Branch in Manitoba who had been assistant chief on the survey of a portion of the Manitoba-Northwest Territories boundary, should be chief of party, and that his assistant should be a Saskatchewan Land Surveyor on the staff of the Surveys Branch in Saskatchewan. Later, W. M. Schwartz, D.L.S., S.L.S., was appointed assistant chief.

The Commissioners agreed that other party personnel should be drawn equally, as far as practicable, from Manitoba and Saskatchewan.

Agreement was also reached for the field party to be outfitted by drawing upon the equipment resources of each of the survey organizations represented by the respective Commissioners, each to share as nearly equally as possible in contribution.

CHAPTER II

METHODS PRESCRIBED FOR SURVEY

COMMISSION INSTRUCTIONS TO SURVEYOR

General

At the Commission meeting on June 30, 1960, the Commissioners felt that a number of specific decisions should be made before the instructions for the survey were prepared. These decisions dealt particularly with the confirmation of previous unconfirmed surveys of the second meridian and the monumentation of the boundary.

From all evidence available to the Commission it was apparent that the portion of the interprovincial boundary which comprised the second meridian of the Dominion Lands surveys system would start at the correction line between townships 82 and 83. The second meridian across townships 83 and 84 and for a short distance into township 85 had been surveyed by E. W. Robinson, D.L.S., in 1913, and resurveyed by A. H. Hawkins, D.L.S., in 1915, but the survey of this portion had not been confirmed. The Commission had previously decided to begin the survey of the unsurveyed portion of the meridian at the northeast corner of township 84, and the Commissioners now agreed to confirm the unconfirmed surveys of the meridian across townships 83 and 84. The few survey monuments in township 85 were to be tied in by the boundary surveyor, then destroyed and the survey across the southern portion of township 85 was to be regarded as an original survey.

Further decisions made at the June 30 meeting were as follows:

Monumentation of Boundary

A previous decision to monument the northeast corners of sections 13 and 36 in each township was reversed in view of the possible cumulative effect of chainage errors. The following amended principles regarding monumentation of the boundary were then agreed upon:

- (a) Monument intervisible points only, at an average interval of $1\frac{1}{2}$ miles.
- (b) Maximum interval 3 miles except where crossing water more than 3 miles across.
- (c) Intervisibility between monuments to be maintained throughout, except where it involves placement of monuments less than 400 feet apart.
- (d) Monuments to be numbered consecutively from the beginning of the survey.
- (e) Transit stations not to be permanently marked on the ground.

At a meeting of the Commission on December 28, 1960, shortly before the survey party left for the field, the instructions for the survey were carefully reviewed with Mr. Boutilier and a number of points were clarified regarding disposition of monument components, restoration of monuments in township 84, temperature correction tables, water transfers for main and check levels, ties to tellurometer stations and a few other details.

Survey Instructions 1960-61 Winter Season

The following is a general summary of the instructions issued by the Commission to Mr. Boutilier for the 1960-61 field season:

The second meridian west has been surveyed to a witness monument 26 chains north of the southeast corner of section 13, township 85, range 1 west of the second meridian. This monument was erected by A. H. Hawkins, D.L.S., in 1915.

It is now required to resurvey that portion of township 85 surveyed in 1915, and to continue the survey northerly as a true astronomical meridian to its intersection with the straight line joining Monument 191 and Monument 1 on the northern boundaries of Saskatchewan and Manitoba respectively.

Method of Survey

The survey shall be started by retracing the east boundary of township 84 from the northeast corner of section 1 in that township. Monuments in this township shall be accepted and renewed in accordance with the Manual of Instructions for the Survey of Dominion Lands, 1946 edition.

From the northeast corner of township 84, range 1, west of the second meridian, the survey shall be considered as an original survey and the line produced northerly as a true astronomical meridian. Survey monuments found on the east boundary of township 85 shall be tied in to the survey and then destroyed.

The initial azimuth of the line at the northeast corner of township 84 shall be 0°00'00" as determined by an acceptable set of azimuth observations.

The boundary shall be well cut out to give a minimum sky-line width of six feet and shall be well blazed.

Azimuths

For the purpose of control of alignment of the boundary, precise astronomical observations on Polaris shall be made in accordance with Program for Observing Polaris Using Wild T2 Transit with Striding Level. At least one set consisting of three pairs of individual observations should be made for each six-mile portion of the boundary. In principle, the actual bearing of the boundary shall never depart from the prescribed azimuth by more than 15 seconds of arc. The alignment of the boundary should be adjusted after each observation to correct for indicated divergences from theoretic direction or to compensate for known previous divergences.

The probable error of the mean of any set of observations should be less than 1.5 seconds of arc, where:

$$\text{Probable error} = 2/3 \sqrt{\frac{\sum v^2}{n(n-1)}}$$

v=residual of each individual observation

n=number of observations in the set from which the mean is derived.

If the probable error of the mean of the set is more than 1.5 seconds, further observations should be made until the probable error of the grand mean is reduced to the required limit.

Particular attention should be paid to the determination of local sidereal time for these observations and it is recommended that at least two sidereal watches be maintained in continuous running condition throughout the project. Local sidereal time is to be determined by observation of time stars or the sun. If radio time signals are used for such determinations, as may be necessary on occasion, particular attention should be given to correct evaluation of the longitude used in the time-conversion.

Chaining

Each distance between monuments, as well as all survey connections, offsets or other necessary distances shall be measured by two *independent* equally careful measurements, one in chains and the other in feet. The mean of two such measurements shall be taken as the dimension to be quoted or accepted. The discrepancy between two independent measurements should not exceed one part in thirteen thousand, two hundred.

Account is to be taken of slope, temperature, sag, stretch and tape corrections. All slopes exceeding four degrees must be measured by means of a transit. All tapes are to be certified as to length by the National Research Council. No tape which has been broken and subsequently repaired may be used if the break is within the measuring part of the tape.

Zero chainage for the survey shall be the monument at the northeast corner of section 36, township 84, range 1, west of the second meridian. The chainage notes shall show the north boundary of each successive township at its theoretical distance.

If the nature of the terrain on the boundary is broken, it will be necessary to use the tripod chaining method. If flat stretches are encountered, a simpler method of chaining may be adopted, provided the specified tolerance is met.

Where triangulation is necessary to cross water or other obstacles, the necessary distances are to be obtained by double triangulation.

Independent linear and angular ties are to be made to the Geodetic Station "Boundary" in Reindeer Lake and also wherever possible to the monumented stations of Topographic Survey's tellurometer traverse between Kamuchawie Lake and Monument 191 on the Saskatchewan-Northwest Territories boundary.

Monuments

Permanent monuments are to be erected on the boundary at intervisible points. An interval of about one to one-and-a-half miles is suitable; it should never exceed three miles.

A number of special boundary rock posts have been provided. They are similar to the D.L.S. short standard posts but have a special cap inscribed Manitoba-Saskatchewan. The number of the monument and the year of the survey are to be stamped upon placement. Monuments are to be numbered consecutively from one upward ascending regularly northward. Monument No. 1 shall be the first monument north of township 84. Each post is to be referenced by a pyramidal mound six feet square at the base and thirty inches high, with four pits, four feet square and eighteen inches deep, placed square with the boundary line in accordance with the diagram supplied with these instructions. Bearing-tree reference should also be made where suitable trees exist.

Rock posts are preferable to soil posts for permanency and ease in planting. They are to be cemented or leaded into rock or may be anchored with fused sulphur. A rock mound should be substituted for the earth mound wherever possible and the pits omitted.

Where the use of soil posts is necessitated by the nature of the terrain, the post shall be formed by cementing a rock post in the head of a $1\frac{1}{2} \times 48$ " iron pipe driven in place.

Levelling

Continuous spirit levels are to be run along the boundary line. Each portion of the line is to be levelled and check levelled, to an agreement within 0.1 foot multiplied by the square root of the number of miles levelled between bench marks. The elevation of the top of each monument is to be recorded to the nearest one hundredth of a foot. Bench marks, which may consist of a six-inch spike in a blazed tree, or a cross chiselled in solid rock, are to be located adjacent to each monument and at other suitable points on the boundary, based on the rule that they should be spaced at intervals not exceeding one mile. Bench marks (new) are to be numbered from one upwards.

General Instructions for Levelling on Dominion Lands Surveys is to be followed in principle except that all three wire intercepts on the rod should be read for the main levels. The stadia readings will provide a means of revealing possible errors in chainage.

Water transfers may be used for check levels. Water transfers may also be used for main levels, but only if a careful systematic method of checking is employed. For ordinary lakes, representative ice level may be quoted instead of water level.

The datum for the levels will be bench mark 145 in township 84, established by A. H. Hawkins, D.L.S. in 1915. Elevation 1170.45 is to be assumed for this bench mark and it should be substantiated by levelling from bench mark 144 (El. 1200.58) further south on the second meridian. A vertical tie is to be made to Plug 3 on the 22nd Base Line.

Positions on Air Photographs

The positions of all monuments and the points where the boundary line crosses rivers, creeks, lakes and other identifiable topography are to be pin-pricked on vertical air photographs and identified on the backs thereof with monument numbers and chainages. Only those positions that have been positively identified on the ground are to be pricked through on the photographs. Positions that have been determined in only one sense, either east-west or north-south, are to be marked in ink and an explanation made on the back of the photograph.

Returns of Survey

The returns of the survey are to consist of:

1. General Report
2. Plan of the survey on tracing linen at a scale of 40 chains to 1 inch, including a profile to the same linear scale with a suitable vertical scale
3. A fair copy of the field notes
4. Original field records of astronomical observations for azimuth and time
5. A list of monuments erected, including the number, description, azimuth and distance to the adjacent monuments in each direction, total distance in miles and chains from the starting point, and the elevations
6. Pin-pricked vertical air photographs
7. Official diary
8. Original level books
9. Abstract of levels
10. The original chainage and transit note books, along with the calculation or computation sheets used.

Survey Instructions 1961-62 Winter Season

Prior to the 1961-62 field season, the results of an examination of the returns of the 1960-61 survey of the boundary were made available to Mr. Boutilier. The various comments made by the examiner regarding more efficient methods of operation and recording of survey information enabled Mr. Boutilier to give effect to them on his 1961-62 survey.

On December 28, 1961, a few days before the commencement of the 1961-62 field season, the Commission held a meeting in Winnipeg, at which Mr. Boutilier was present for part of the time. Various aspects of the coming season's work were discussed with him and as the final instructions for the season's work had not yet been drafted, it was agreed that the Manitoba Commissioner should furnish Mr. Boutilier with an interim letter of instructions. This was done and the following is a brief summary of those instructions:

The survey of the boundary is to be continued on the basis of the instructions issued for the previous season's work with a few slight amendments.

The survey is to be started by retracing the line between Monuments 71 and 72 established during the previous season, and then producing the line northerly as a true astronomical meridian. Every effort should be made to obtain an observation for azimuth to verify the direction of the line before erecting Monument 73.

Levelling operations shall begin by relevening between Bench Marks 94 and 95 established during the previous season and a further check made on Monument 72. New bench marks established shall continue with the numbering of the previous season.

In levelling operations, the reading of all three wire intercepts in the main levels may be dispensed with provided satisfactory compliance with other requirements of the instructions can be met and an improvement in progress of this work can be obtained.

For the coming season's work, two motor toboggans will be provided to assist in collecting firewood for camp if necessary.

Further instructions will be issued with regard to the special monument to be erected at the intersection of the Manitoba-Saskatchewan boundary with the existing Manitoba-Northwest Territories and Saskatchewan-Northwest Territories boundaries.

At a later date, the final instructions for the second season's work were issued and in them were incorporated the information and instructions contained in the interim letter of instructions summarized above. These final instructions were, in most respects, similar to those issued for the previous season's work and only the changes and additions require to be stated. These may be summarized as follows:

Monuments

A special aluminum monument $2\frac{1}{2}$ feet high is being fabricated to mark the common corner between the two provinces and the Northwest Territories. A plan of the monument and a plan showing the proposed method of anchoring it in permafrost soil are being forwarded to you and the monument itself, together with a special footing for it, will be forwarded at a later date. The footing is to be placed in accordance with specifications being prepared. The monument is hollow and has a port hole in the bottom fitted with a cover plate and rubber gasket as a moisture seal. It is anticipated that material of historic interest will be inserted in the monument at the time of its erection or on a later occasion.

A three-inch aluminum disc has been fixed to the top of the monument. The point of intersection of the boundary shall be marked on the disc by three well-indented chisel marks to coincide with the boundary lines between Saskatchewan and the Northwest Territories, Manitoba and the Northwest Territories and the common boundary between Manitoba and Saskatchewan. After the monument has been set, all angles at the point of intersection shall be carefully measured and distances from the point of intersection to the Northwest Territories boundary posts immediately east and west shall be chained and check chained.

It is probable that the corner will fall in comparatively low-lying tundra, which, due to typical moss cover and lack of surface drainage may be wet in summer. If conditions are found unsatisfactory, recommendations for monumentation should be submitted.

Levelling

The final bench mark placed on the survey will be in the immediate vicinity of the special corner monument. From this bench mark, levels and check levels shall be run to the bench marks immediately east and west of the corner on the Northwest Territories boundary.

The above instructions regarding the special aluminum monument were supplemented by special instructions issued by the Manitoba Commissioner relative to placing the monument in position. These may be summarized as follows:

The footing, consisting of a four-inch diameter galvanized pipe, eight feet long, filled with cement mortar and having at its upper end a fourteen-inch square steel plate, shall be

placed by excavating a hole to the required depth. The top of the footing should be approximately 20 inches above ground level when in position. A hole, three to four feet square, may have to be excavated for a depth of three to three and one half feet and then a smaller hole made to the required depth. The pipe is to be anchored by placing two steel rods, one half inch in diameter by eight inches in length, through holes in the pipe at its lower end. The bottom portion of the hole shall be back filled with sand and gravel and well tamped and the remainder of the hole shall be filled with alternate layers of three inches of Zonolite insulation and twelve inches of clean sand or gravel.

Before attaching the aluminum monument to the footing, it may be appropriate to place inside the monument a short note giving particulars of the survey and signatures of all men on the party. The plate on the bottom is to be properly tightened before the monument is attached to the footing by bolts.

The stone base may then be erected around the portion of the footing above ground level. The outside edges of the base are to be of stone while the inner two or three feet around the footing should be mostly sand and gravel. The base for the monument should be six feet square at the top and nine feet square at ground level.

CHAPTER III

DEMARCATIION SURVEYS

The demarcation of the second meridian portion of the boundary north of township 84 required the survey and monumentation of almost 254 miles of line, most of which was in wooded country. On the basis of the amount of line completed on comparable surveys in northern Manitoba in former winter seasons, the Commission felt that, with no severe set-backs in the field operations, the project could be completed in two winter seasons. With this objective in view, the Commission issued instructions for the survey to Mr. Boutilier, who set as his objective the survey of approximately half the distance during the 1960-61 winter season.

Prior to receiving his instructions, Mr. Boutilier proceeded to Regina to discuss various phases of the survey with Mr. Bereskin, the Saskatchewan Commissioner, to meet Mr. Schwartz, his assistant on the survey party and to familiarize himself with the Saskatchewan Government accounting system.

FIELD OPERATIONS 1960-61 WINTER SEASON

From North Boundary of Township 84 to Monument 72

Organization

Organization of the survey party began early in November, 1960. The two provincial Commissioners hired the members of the party, half from Manitoba and half from Saskatchewan.

Orders for supplies were placed through the Saskatchewan Government Purchasing Bureau. The Department of Mines and Technical Surveys, Ottawa, provided two Wild T2 theodolites and three sidereal watches for use on this survey. The Manitoba Surveys Branch supplied all the camping equipment and half the remaining surveying instruments required, while the Saskatchewan Surveys Branch supplied all the dishes and the remaining survey equipment required.

Arrangements were made with the Manitoba Government Air Service to provide air transportation to and from the survey and to base an aircraft at the survey camp for the duration of the survey.

Radio communication from the survey camp was established by the Manitoba Government Air Service through its network in Manitoba. This service was made available to the chief of party and to ensure a fair measure of reliability, a 40-watt transmitter-receiver was maintained in the survey camp and at Lynn Lake, the latter station serving as a relay station between the survey camp and the Air Service base at The Pas.

The survey party was composed of 20 men, their positions and duties being as follows:

Chief of party	—Direction and general supervision
Assistant	—Main line production and observing
Two chainmen	—Main chainage
Two chainmen	—Check chainage
Leveller and two rodmen	—Main and check levels
Pilot transitman	—Line production for axemen
Moulder and one helper	—Monument construction
Picketman and five axemen	—Line cutting
Cook and helper	

Attached to the party were the pilot and air engineer of the aircraft while based at the survey camp.

Well before the date of departure of the party, all supplies and camp equipment were sent by rail to Lynn Lake which had been selected as the assembly point for the party and the base for storage of supplies.

Departure for Survey

On the morning of January 4, 1961, Mr. Boutilier and two men left Lac du Bonnet by air for Lynn Lake. On arrival at The Pas at noon, it was learned that a delay was inevitable owing to adverse weather conditions farther north. The flight was continued on January 6 but instead of proceeding to Lynn Lake, the aircraft headed for Kamuchawie Lake on the boundary where Camp No. 1 was to be established. Here a suitable campsite was located and the instruments and some camp equipment were unloaded. The aircraft then went to Lynn Lake where the other Manitoba members of the party had arrived by train the previous evening. On the afternoon of January 6 the Saskatchewan members of the party arrived on a Saskatchewan Government Airways aircraft.

The following days, January 7 and 8, were spent transporting men, equipment and supplies to Camp No. 1 and making preparations for the commencement of the survey.

Transportation

Transportation throughout the season was mainly supplied by the Manitoba Government Air Service, which based an Otter aircraft at the survey camp.

The aircraft had four main uses:

1. Transporting supplies and equipment from Lynn Lake to the survey camps, which necessitated return flights varying from 70 miles to 110 miles depending on the camp locations.
2. Moving the camp along the line as the survey progressed. This required numerous take-offs and landings with very little actual flying time. On the average, five trips were required to move the camp. Generally one full

day was required to move the camp but on most moving days, a few of the technical personnel continued working on lagging phases of the survey to sustain uniform general progress.

3. Flying men to and from the end of the line when it was four miles or more from camp and where conditions for landings and take-offs were favourable. This practice has been found particularly helpful as it provides more time for work on the line, and enables, by reduction of walking, conservation of the men's energies for technical work.
4. The aircraft could be made operational in approximately one hour in case of accident.

When the survey reached the south end of Reindeer Lake, a Bombardier* was hired from the Saskatchewan Government for four days to assist the party in carrying the survey across the first 12-mile stretch of lake.

Accommodation

The party members lived in tents provided with double walls and wood-fired airtight heaters. The camp was composed of five 14-ft by 14-ft tents and one 16-ft by 21-ft cook tent. Four men slept in each 14-ft by 14-ft tent while the cook and his helper slept in the cook tent. The office tent provided sleeping accommodation for the pilot, engineer, assistant and party chief and space for the transmitter-receiver and sundry office equipment. The cook tent was used as a dining tent and at each camp a table 20 ft long with benches attached was set up.

Survey Operations

Survey operations began on January 9 by retracing five miles of the east boundary of township 84, range 1, west of the second meridian, from the northeast corner of section 36 to the northeast corner of section 1. The monuments found



Survey camp on boundary line

* A gasoline-powered vehicle with tracks at the rear for traction and support and skis at the front for steering. It has a closed-in cabin for carrying men and equipment.

during this retracement were renewed in accordance with the Manual of Instructions for the Survey of Dominion Lands, 1946 edition, except that the old-pattern iron posts found at each monument were replaced with short bronze rock boundary posts cemented into rock or into iron pipe, and all were correctly aligned.

A portion of the 22nd base line was also retraced as far east as Monument P3 (Plug 3) and angular and linear measurements made to this monument from the second meridian for comparison purposes.

The survey of the portion of the boundary covered by the Commission instructions was then commenced by producing the second meridian north as a true astronomical meridian, adjusted as necessary to reflect observed azimuths, from the northeast corner of township 84. The monuments on the meridian in township 85 erected by A. H. Hawkins, D.L.S. in 1915, were tied in and then destroyed in accordance with instructions.

During the first two weeks of work the temperature remained above normal and gave the less experienced men on the party a good opportunity to become familiar with their duties.

The great disadvantage of the mild weather was the almost continuous light snow which accompanied it and which hampered line production and observing.

By the end of January, 24 miles of the boundary had been surveyed and hopes were high for greater accomplishments in February. These, however, did not materialize as several cases of sickness and a few minor accidents resulted in the loss of 38 man-days in February. This loss of time, coupled with heavier cutting on line, resulted in only 28 miles of boundary being surveyed during the month.

The survey continued without interruption until March 25 when a heavy snow storm kept the party in camp for three days.

The survey had reached the south shore of Reindeer Lake on March 20 and on the following day, March 21, by previous arrangement, a Saskatchewan conservation officer from Kinoosao, a fishing station on the shore of the lake, arrived at camp to assist with his Bombardier in transporting the men and equipment while surveying the boundary across the lake.

This officer assisted the survey party until it reached the north end of Boundary Island and then, owing to prior commitments, had to return to Kinoosao on March 24.

On March 28 the final camp move for the season was made to a large island near the north end of Reindeer Lake. From this camp, the survey was continued from the north end of Boundary Island.

On the afternoon of April 3 the work for this season terminated on a small island in Zangeza Bay of Reindeer Lake at latitude $58^{\circ}02'38''$. Later that same day, five men were flown to Lynn Lake where four of them proceeded to their homes by rail and the fifth remained at Lynn Lake. On April 4, the remaining men from Manitoba, with instruments and camp equipment, were flown to Lynn Lake and thence south to Lac du Bonnet from where they proceeded home. That same day, a Saskatchewan Government Airways aircraft picked up the ten men from Saskatchewan and flew three to their homes at Kinoosao, and seven to Lac la Ronge from whence they proceeded home.

A summary of the season's work follows:

January

17 days working on line
4 days moving camp
2 days off for Sundays
5.5 miles of retracement survey
24 miles of new boundary line completed } (7 miles on ice).

February

20 days working on line
4 days moving camp
4 days off for Sundays
28 miles of boundary line completed.

March

20 days working on line
4 days moving camp
7 days off for Sundays and snow storms
58.7 miles of boundary line completed (28 miles on ice).

April

3 days working on line
1 day moving camp to railhead
7.6 miles of boundary line completed.

Total for season—118.3 miles of boundary survey.
5.5 miles of retracement survey.

The various individual operations of the survey were carried out in accordance with Commission instructions and are described hereunder.

Line Production

Production of the line was carried out with a Wild T2 theodolite. The method used was the Eyepiece Micrometer Method, described in a report by C. M. Duncan, D.L.S., dated May 19, 1955.

In this method, two targets, a measured distance apart, are solidly placed astride the approximate line (determined by the pilot transit) at the forward station. The angles between the line being produced and each of the forward targets are then observed with a theodolite set up at the end of the existing line. After an adequate series of horizontal circle readings has been taken in both direct and reverse positions of the theodolite, the position of the prolonged straight line may be calculated with respect to the two forward targets. It can then be located at the forward position by a simple proportioning of the distance between the two targets.

Until the boundary line reached the south shore of Reindeer Lake, the average distance between stations was 1.3 miles. Crossing Reindeer Lake, stations were spaced about 3 miles apart.

The survey of long straight lines is one of the more difficult tasks encountered on field surveys when the tolerance of deviation is restricted to comparatively small limits. Best results have been obtained by careful production combined with frequent astronomical observations for azimuth. On this survey, both operations were carried out under severe winter conditions. Observations were restricted to clear days and could not always be carried out at optimum intervals along the line without serious effect on progress of the survey.

Assessment of the line production indicated that due care had been taken by the surveyor. On ten occasions deflections were made to correct the line for drift indicated by azimuth observations. Eight easterly deflections were made, varying from 3 to 10 seconds of arc with a total easterly correction of 57 seconds of arc. Two westerly deflections of 16 and 9 seconds respectively were made in a similar manner. Due to an error in time conversion for the first azimuth observations, the initial azimuth of the line was 12 seconds east of north; the direction of the last course monumented for the season was determined by observation to be 18 seconds west of north. As a result of this the monumented boundary deviates from the previously defined meridian for, as is customary the boundary was monumented as the survey progressed. This avoided the rather large expenditure which would be involved in carrying out the final monumentation after the initial survey had been made and fully examined. In the present case the resulting deviations of the monumented boundary from the theoretical meridian passing through the starting point of the survey have been computed from the final returns for the survey and are very small: up to Mile 24 the deviation did not exceed 2 ft, from Mile 24 there was a gradual increase to 6.3 ft west at Mile 65, from this point it was generally between 5.6 ft and 3.6 ft west until Mile 118, where it was 6.5 ft west at the end of the season's work. These deviations are not considered significant and in the opinion of the Commission, justify the decision to carry out the monumentation simultaneously with the survey.

Azimuths

A total of 27 sets of astronomical observations on Polaris were taken during the season. The average distance between observations was 4.6 miles. On Reindeer Lake, the distance between observations twice exceeded the limit of 6 miles specified in the instructions owing to unsuitable weather for observing, and the rapid progress of the survey across the lake.

Analysis of the 27 observations indicates that Mr. Boutilier was unable to maintain consistently the precision of observation indicated by his instructions. The extreme difficulty of delicate and precise manipulations of instrumental equipment in sub-zero weather, together with mechanical reluctances of the equipment itself will explain the shortcomings. The average probable error of all his observations was 1.5 seconds, the stated tolerance.

All astronomical observations were taken with a Wild T2 theodolite fitted with a stride level. The method of observing was as follows: The theodolite was first set up, centred on the station mark, and then carefully levelled by means of the stride level. After pointing on the reference object the horizontal circle was oriented to conform to the azimuth by account of the reference line. The telescope was then sighted on Polaris. An accurate pointing was made on Polaris and the exact watch time recorded. The stride level, with the larger graduation to the west, was read and recorded and then reversed; after it settled it was again read and recorded. The horizontal circle was then read without moving the telescope and the micrometer readings were repeated three times and recorded. The telescope was then pointed on the reference object three times in succession and each reading recorded. The telescope was then transited and the above procedure repeated.

This constituted one individual observation and the whole procedure was repeated from three to six times to complete one set of observations for azimuth.

To maintain accuracy, the instrument and tripod were always shaded from direct sunlight, the instrument was always turned in one direction and final settings were made by turning tangent screws against the springs.

Local sidereal time was determined from radio time signals and from meridian transits of time stars or the sun. Two sidereal watches were kept running during the entire season and two daily radio time checks were taken and recorded each day on both watches. The best source of radio time was WWV Washington, D.C., on frequencies of 10 Mc and 15 Mc.

Linear Measurements

All linear measurements were made with steel tapes calibrated by the National Research Council at Ottawa. For each distance, two independent measurements were made, one in chains, the other in feet. The mean of the two independent measurements was accepted as the correct length and if in any case the difference between these measurements exceeded one part in 13,200, the distance was remeasured.

While Commission instructions called for the use of the tripod method of chaining except in flat country, the excellent results obtained on the survey of the north boundary of Manitoba by simply chaining along the ground influenced Mr. Boutilier to adopt this method for his survey. Verbal approval of the Commission was obtained for this method of chaining.

Both groups of chainmen used the same methods of operation and both exercised extreme care. Corrections were applied for temperature, slope, sag and tape length. All slope angles were measured with a theodolite. The method of reading temperatures and the use of tension handles was described by Mr. Boutilier thus: "On one of the legs of the chainage theodolite, a thermometer was fastened and at regular intervals throughout the day, this thermometer was read along with one placed in the shade on top of the snow. If the chain had been supported on top of the snow, the reading from the thermometer on top of the snow would be

recorded. If the chain had been suspended in the air, the reading from the thermometer on the theodolite was recorded.

"All pulls were made using tension handles which were tested regularly with a weight, adjusted by the National Research Council to exactly 20 pounds, the tension when the tapes were originally tested. The chainmen used a 20-pound tension for all pulls whether supported or suspended".

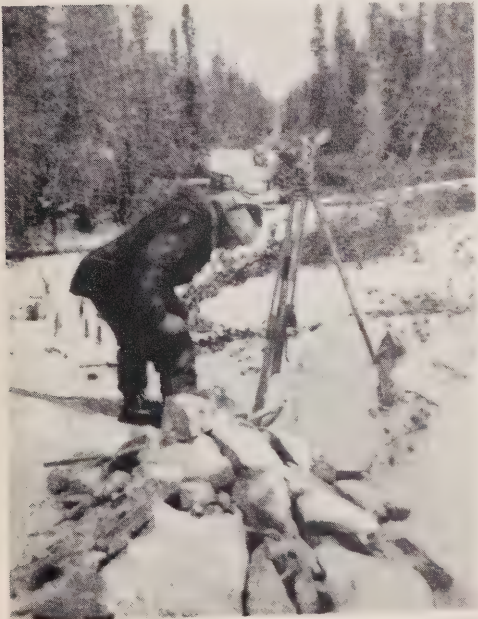
Monuments

Survey monuments were erected at intervisible points along the line and were numbered consecutively from one upward, with Monument 1 being the first monument north of the northeast corner of township 84. All monuments consisted of short bronze posts cemented in rock except in the case of Monuments 40 and 46 where the posts were cemented into 4-ft galvanized iron pipes, 1½ in. in diameter, driven into the ground. One foot south of each post a rock mound was erected, 6 ft square and 30 in. high.

A total of seventy-two monuments was placed on the boundary. Between the starting point and the south shore of Reindeer Lake, the distance between monuments averaged 1.3 miles. Within Reindeer Lake, monuments were placed on all islands crossed by the line.

Use of a portable, gasoline-powered rock drill, and blasting of rock by dynamite proved very helpful in providing sufficient rock for the mounds.

A summary of monument data is given in Appendix I.



Chainmen at work

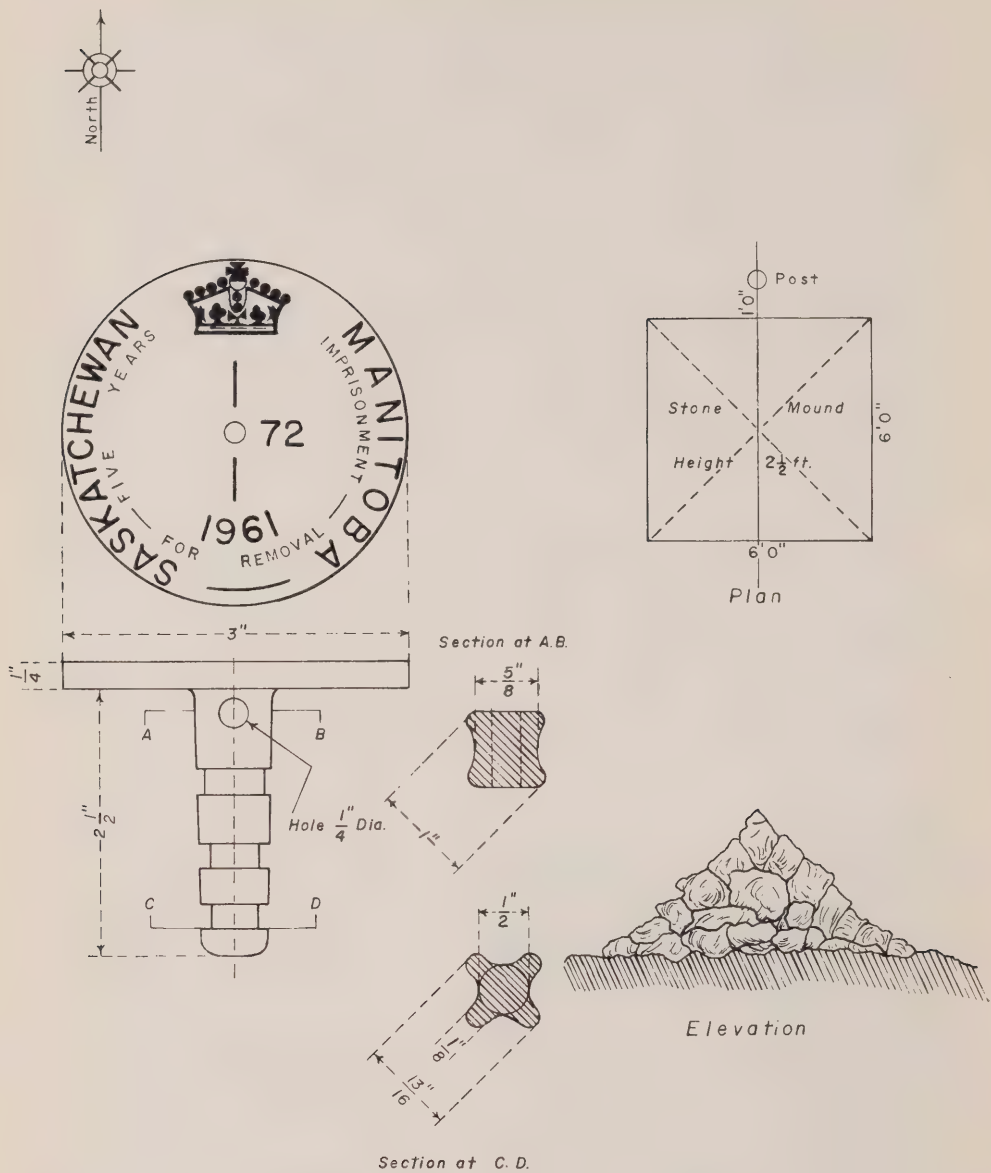
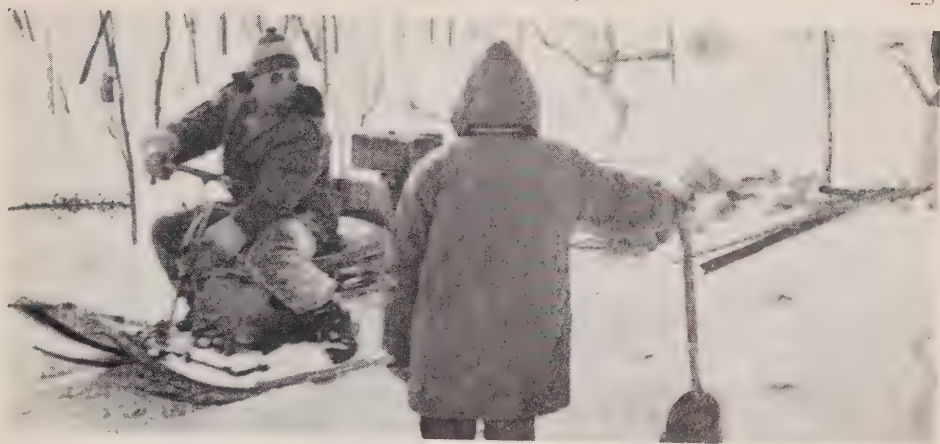


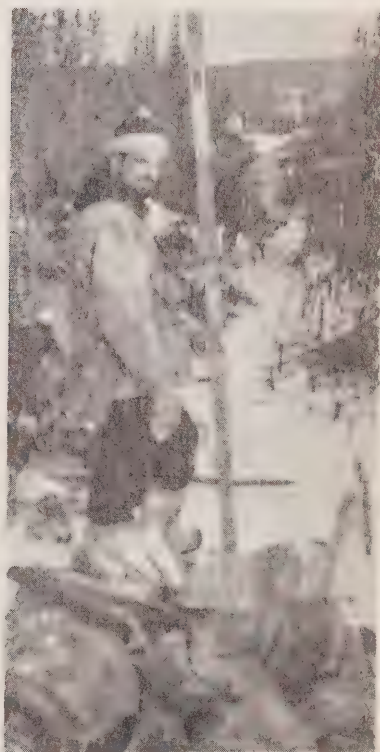
Diagram showing rock post and stone mound



Hauling rock by motor toboggan for construction of mound



Moulder drilling hole in rock for post



Obtaining elevation of rock post

Levelling

Continuous spirit levels were run along all the boundary except across 25 miles of ice at the northern end of Reindeer Lake where a water transfer was taken. Each portion of the boundary was levelled and check levelled, the main and check levels being run in opposite directions. Stadia readings were recorded on all main level sights, including sights on bench marks and monuments and also on chainage tally points as a check on the accuracy of the stadia readings.

Bench marks were established at intervals of one mile or less with few exceptions throughout the survey and whenever a lake of significant size was crossed by the line, a bench mark was established near the shore. Bench marks were made by driving a 6-in. spike into a tree, blazing the tree above the spike and carving the number of the bench mark on the blaze.

Standard levelling procedures were interrupted at Mile 81 on reaching the large expanse of ice on Reindeer Lake, which extended for 25 miles along the boundary. Disturbance of the survey instrument due to wind on the exposed lake would have made instrumental levelling less reliable than that of a systematic transfer made by water. The surveyor therefore decided to make the water transfer and adopted the following procedure:

Spirit levels were carried forward to B.M. 84 on the south shore of Reindeer Lake and a second bench mark was prepared on the north shore. Three water holes were opened well out in the lake from each of these bench marks. On the south shore, where conditions appeared very favourable, the holes were spaced about 500 feet apart. On the north shore, conditions were less favourable and the spacing between holes was increased to approximately half a mile. On a day when the aircraft was moving the camp and was flying from the south to the north shore, separate lines of levels were run from each water hole to the bench mark on the near shore. The elapsed time between levelling operations on each shore was approximately 40 minutes. The complete levelling operation was carried out twice on the one day and was repeated a third time five days later. Two methods of taking the water level were used, one by submerging the foot of the rod and reading the intercept of the water surface which was deducted from the rod reading, and the other by driving a nail into a slightly submerged shelf on the side of the water hole until the head of the nail was level with the water.

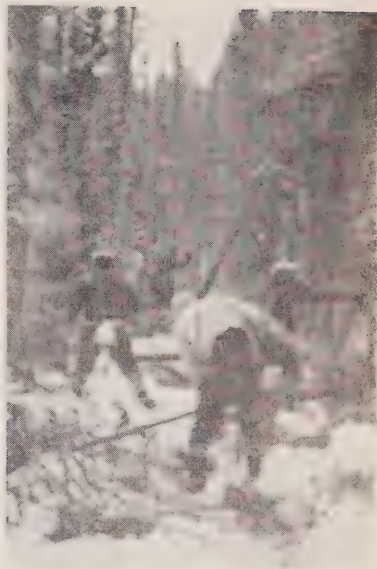
Near all islands crossed by the boundary, water holes were opened to provide a datum from which to run levels over the islands.

According to instructions, B.M. 145 on the second meridian in township 84 was to be the datum for the levels and was to be substantiated by B.M. 144. B.M. 145 could not be located as the surrounding area had been burnt over. B.M. 143 farther south was located, and being substantiated by B.M. 144, was used as the datum.

Line Clearing

The boundary line was cut out to provide a minimum skyline width of six feet and trees on each side of the line were blazed in accordance with Clause 97 of the 1946 edition of the D.L.S. Manual of Instructions.

Axemen at the head of the line



Blazed jackpine, vicinity of Reindeer Lake



Geodetic survey shoran station "Boundary"
on Boundary Island in Reindeer Lake

Connections to Previous Surveys

Ties were made to Geodetic Survey shoran station "Boundary" on an island in Reindeer Lake, to three monumented stations of the Topographical Survey's tellurometer traverse between Kamuchawie Lake and the north boundary of Saskatchewan, and, as previously stated, to Plug 3 on the twenty-second base line.

"Boundary" shoran monument consisted of a brass cap set in concrete under a 30-ft wooden pole tower. The monument and tower were erected in 1950 and were in very good condition.

Angular and linear ties were made to station "Boundary" and to Monument A83 of the tellurometer traverse. These were also tied in with the levels. Monuments A85 and A86 of the traverse were tied in by triangulation but attempts to tie in Monuments A51 and A77 on boulders on the shore of Reindeer Lake proved futile as they were covered with ice.

General

In concluding his report, Mr. Boutilier mentions the following factors which, he felt, contributed to the success of the season's operations: "The snow throughout the winter remained soft and was not drifted on the lakes, making it ideal for the landing of aircraft.

"Reindeer Lake, being a large lake, is in most winters covered with hard packed snow drifts. This winter was an exception and the aircraft was able to land wherever required on the lake, being of great advantage when the Bombardier had to leave the survey with the line only half way across.

"Rock was found along the entire boundary, which was a great advantage for mounding.

"The men all had pride in their work and were very co-operative, all through the winter. Their morale remained high throughout. Edward Madsen, our cook, deserves a lot of credit for this by preparing such excellent meals.

"Having the aircraft based at camp was a contributing factor to the success of the survey, both for the amount of work done by it, the walking that it saved and the security of having it there in case of an emergency; this eliminated any worry the men might have had."

SURVEY STATISTICS
1960-1961

Boundary completed	118.3 miles
Retracement surveys	5.5 miles
Monuments placed	
Rock post, stone mound	70
Post in iron pipe, stone mound	2
Monument interval, average, wooded country	1.3 miles
Monument interval, maximum, wooded country	2.8 miles
Monument interval, maximum, Reindeer Lake	10.1 miles
Bench marks established	95

Average distance between bench marks to south shore of Reindeer Lake	1.0 mile
Boundary, clearing, blazing, monumenting—average	1.5 miles per day
Camp moves	11
Days lost due to weather, transport	3
Accidents	4 minor
Sickness in camp	4 minor
	3 major
Replacements due to sickness	3
Labour relations	Good
Party strength	20

FIELD OPERATIONS 1961-62 WINTER SEASON

*From Monument 72 to South Boundary of Northwest Territories**Organization*

Mr. Boutilier was again appointed to take charge of the party to continue the survey of the boundary and, as in the previous season, the party operated under the administrative direction of Mr. Bereskin, the Saskatchewan Commissioner.

The same arrangements were made by the respective government survey organizations to supply camp equipment and instruments, with the addition, this season, of two motor toboggans on loan from the Department of Mines and Technical Surveys.

The party numbered 22 men, including the pilot and engineer of the aircraft. Fortunately, 12 of the men had been on the party during the previous season and consequently were fully conversant with their duties. The composition of the survey party was as follows:

- L. E. Boutilier, M.L.S.—*Chief of party*
- R. Madden, S.L.S.—*Assistant*
- W. I. White, S.L.S.—*Relief assistant* (February 22- March 11)
- Leveller and two rodmen
- Head chainman and three men
- Pilot transitman
- Picketman and five axemen
- Mounders and toboggan drivers (2)
- Cook and helper

Arrangements were made for the Manitoba Government Air Service to provide air transportation and radio communication facilities in a manner similar to those provided the previous season.

Departure for Survey

On January 2, 1962, Mr. Boutilier and one man left Winnipeg by air for Lynn Lake where the party was to be assembled. In succeeding days the other members of the party, some from Manitoba and some from Saskatchewan arrived by train or plane.

On January 3 Mr. Boutilier made a trip in a Manitoba Government Air Service aircraft to the boundary and selected the first camp site for the season. On January 4 a second aircraft from the Manitoba Government Air Service arrived to assist in transporting men and equipment from Lynn Lake to Camp No. 1. Equipment stored at Brochet after the previous season was picked up and taken to Camp No. 1. Due to engine trouble on one aircraft and unsuitable weather for flying, the camp was not fully set up and manned until January 7. Camp accommodation was the same as that of the previous season.

Transportation

Transportation throughout the survey was again provided by the Manitoba Government Air Service which based an Otter aircraft at the survey camp. It was used in the same manner as described in the previous season's operations.

The provision of motor toboggans to assist in ground transportation proved very useful. One of the two toboggans was used principally for gathering firewood for the camp and hauling camp equipment to and from the aircraft on moving days. Sometimes it was used to transport men and equipment to and from work and to assist the mounders in hauling rock for mounds. The other toboggan was stored at Lynn Lake in case of emergency.

Survey Operations

Due to a snowstorm on January 8 the season's operations did not get under way until January 9 when the retracement of the boundary between Monuments 71 and 72 and the relevelling between Bench Marks 94 and 95, established the previous season, were completed and the survey of the new portion of the boundary was started.

Progress was good and on January 13 the first camp move was made. As a general rule, camp was moved once a week and moving day was generally very strenuous on account of the large amount of snow to be shovelled in setting up the new camp.

Regarding camp moves Mr. Boutilier reported:

"It had been our practice on the day prior to a camp move to take one load ahead to the new camp site. The aircraft on this trip packed a runway, which, in the event of slush, froze overnight and established a suitable runway for the move on the following day. However, on moving to Camp No. 5, weather did not permit flying the day previous to the move and the aircraft was stuck in slush on the first trip. The temperature at the time (the plane was stuck) was -42°F and windy. It took five men more than two hours to free the aircraft. Once again darkness set in before camp was completely set up".

At Camp No. 2 about half of the party had influenza and considerable time was lost. The temperature remained low in January (-57°F on January 16) but the weather held clear and the work continued without interruption. The temperature remained below normal during February and the first week in March.

At the end of February the line reached the Cochrane River and from this point north it was found necessary to space the camps farther apart as there were no suitable lakes for the usual spacing of 6 to 8 miles. For the remainder of the survey, the camps were 10 to 12 miles apart.

The good progress continued and on April 5 the line reached the south boundary of the Northwest Territories. On April 6 the party spent the day erecting the final monument on the south boundary of the Northwest Territories.

On the following day, April 7, all men and equipment were flown to Lynn Lake and by April 9 all members of the party had left by air or rail on their journey home.

The following is a breakdown of the work each month:

January

- 6 days to reach and establish Camp No. 1
- 16 days working on line
- 3 days moving camp
- 3 days off for Sundays
- 28 man-days lost due to sickness
- 31.3 miles of boundary surveyed (5 miles of lake).

February

- 19 days working on line
- 5 days moving camp
- 4 days off for Sundays
- 24 man-days lost due to sickness, etc.
- 40.2 miles of boundary surveyed (8 miles of lake).

March

- 22 days working on line
- 4 days moving camp
- 5 days off for Sundays
- 20 man-days lost due to sickness, etc.
- 51.8 miles of boundary surveyed.

April

- 5 days working on line
- 1 day moving camp
- 3 man-days lost due to sickness
- 12.1 miles of boundary surveyed.

Summary of Results

The survey operations were carried out in a manner similar to those of the previous season and may be summarized as follows:

Line Production

The boundary line was produced for a total distance of 135.5 miles. A Wild T2 theodolite was used following the two-target method previously described.

In wooded country the average distance between transit stations was 1.45 miles.

Assessment of the line production as in the previous season indicated that due care had been taken by the surveyor to obtain good alignment. After an initial correction of 10 seconds east at Monument 72, thirteen deflections were made in the line where azimuth observations indicated a drift. Nine westerly corrections were made, varying from 3 to 23 seconds, for a total westerly correction of 71 seconds. Four easterly corrections were made varying from 8 to 20 seconds for a total easterly correction of 47 seconds.

The resulting deviation of the monumented boundary from the theoretical meridian passing through Monument 72, was computed from final returns for the survey and was comparatively small. The extreme variations were from 4.8 ft west to 1.8 ft east for the first 108 miles. Farther north, the drift of the line persisted in an easterly direction and due to unfavourable weather for observing, normal corrections could not be applied. A further drift of 6.5 ft occurred in the last 27.5 miles. This drift was largely offset by the predominant westerly drift of the previous season so that the northern end of the line is estimated to be only 2.8 ft east of the starting point for the previous season 250 miles to the south.

Azimuths

Thirty sets of azimuth observations were taken during the season, twenty-five of which were used to control the direction of the line. The average spacing for the twenty-five observations was 5.65 miles which was within the prescribed 6-mile spacing considered desirable for effective control.

An analysis of the twenty-five observations shows that, as in the previous winter, Mr. Boutilier was unable to achieve consistently the precision specified for the azimuth observations. The extreme low temperatures and excessive snow had added to the normal difficulties experienced in winter observations. In his report Mr. Boutilier made the following comment about the observations at Station 95: "At this station, for some unknown reason, we were unable to obtain a set of observations giving probable error of 1.5 seconds. A mean of nine observations taken gave a probable error of 2.2 seconds." A prolonged period of unfavourable weather during the last week of operations when the line was near completion, prevented Mr. Boutilier from obtaining complete sets for two observations. The average probable error of the twenty-three completed sets of observations was 1.6 seconds, slightly above the specified tolerance.

With regard to time checks, Mr. Boutilier reports that:

"Two sidereal watches were kept running during the entire survey and on all days when radio reception permitted, two daily time checks were taken and recorded on both watches throughout the winter.

"A portable short-wave R.C.A. Victor radio used on this survey performed very well, although the cold weather during camp moves and each night when the fire in the tent died down, shortened the life of each battery to about four to five weeks. The best source for time signals was station WWV Washington, D.C. on frequencies of 10 Mc and 15 Mc. We were able to receive them at most times of the day. All sun checks for time agreed very well with the radio time checks."

Linear Measurements

The method of chaining used was identical to that of the previous season and the same care was exercised by the chainmen. Regarding the chaining operations Mr. Boutilier reports as follows:

"In general, throughout the winter, chainage parties terminated at the end of the day at different points. On days that both parties ended at the same point, the last chaining pins before the terminal point on both parties were left in and guard stakes placed over them. The following morning these ties were checked before proceeding on with the next course.

"Each night the chainmen computed their distances, and calculations were checked by the rear chainmen. The distances were then compared and if comparison differed by an amount greater than the permissible error, one of the chainage parties would recheck his course the following day. Approximately eight distances had to be rechained during the entire winter.

"The chainage method used on this survey gave satisfactory results and went along very smoothly throughout the season. The men on both chaining parties were experienced and capable, and took great pride in their work.

"On one portion of the line south of Monument 92, triangulation had to be used in order to carry the distance up the side of a very steep hill. A double triangle was used and both bases were double chained and all angles read with a Wild T2 theodolite."

Monuments

Survey monuments, similar to those placed in 1960-61, were erected at intervisible points along the line and were numbered consecutively from 73 upwards. A total of eighty-five monuments was erected, the average distance between them being slightly more than one and a half miles.

Stone mounds were built at all monuments except four, where no rock was available. At these four points, the short rock post was cemented into a 4-ft galvanized iron pipe, 1½ in. in diameter, driven into the ground and referenced by a pyramidal earth mound 6 ft square at the base and 30 in. high, with four pits, 4 ft square and 18 in. deep placed square with the boundary line, the north edge of the mound being 1 ft south of the post.



Moulder excavating a pit with portable gasoline-powered drill



Mounders ready to move to next monument



Boundary vista, looking north from Monument 103



Rodman holding rod on bench mark

At the request of the Saskatchewan Commissioner, Mr. Boutilier selected a small sample of rock from each rock mound erected north of Monument 88. At the end of the season these were forwarded to the Mines Branch of the Department of Natural Resources at Regina for examination.

The establishment of the terminal monument at the intersection of the boundary with the south boundary of the Northwest Territories is described in Chapter IV.

Levelling

Continuous spirit levels were run along the boundary in the same way as for the previous season except that no stadia readings were recorded.

Water transfers were used to carry the elevation across several large lakes, all transfers being checked on a different day from that on which the first one was made.

Bench marks were established at an average distance apart of slightly more than the one mile suggested in the instructions. This was due mainly to the fact that the line crosses extensively burnt-over country with no green trees or rock available for bench marks. In his report on this phase of the levelling operations Mr. Boutilier writes "The majority of monuments had the brass caps cemented into large boulders, which, in my opinion will serve as excellent bench marks."

Connections to Previous Surveys

Connections were made to four monumented stations of the Topographical Survey's tellurometer traverse survey. Both angular and linear ties were made to Monuments A16 and A45 while ties to A18 and A49 were made by triangulation. Connections were also made with Monument 191 of the Saskatchewan-Northwest Territories boundary survey and Monument 1 of the Manitoba-Northwest Territories boundary survey.

General

Referring to his season's operations Mr. Boutilier states:

"This survey has given me a great feeling of satisfaction as a steady rate of progress was maintained throughout the winter. The main difficulties encountered were deep snow and severe weather. The snow was four to five feet in depth, which created more work than usual in shovelling out for tents on move days.

"No member in the crew received any serious injury nor suffered from frost bite to any great extent."

Mr. Boutilier remarks on the high morale and co-operative spirit of the men on the party and again gives credit to the same cook, Edward Madsen, for his excellent meals, and to the pilots and engineers of the aircraft in maintaining excellent air service, throughout the entire season.



Pilot transit on top of esker near Monument 106



Boundary crosses high hill—"Old Baldy"

SURVEY STATISTICS

1961-1962

Boundary completed	135.5 miles
Monuments placed	
Rock post, stone mound	74
Post in iron pipe, stone mound	6
Post in iron pipe, mound and pits	4
Terminal monument—aluminum obelisk	1
Monument interval, average wooded country	1.45 miles
Monument interval, maximum	4.5 miles
Monument interval, minimum	0.15 miles
Bench marks established	112
Average distance between bench marks	1 mile +
Boundary-clearing, blazing, monumenting—average	2.0 miles per day
Camp moves	13
Days lost due to weather	1
Accidents	1 minor
Sickness in camp	75 man-days lost
Replacement due to accident	1
Labour relations	Excellent
Party strength	20

CHAPTER IV

ESTABLISHMENT OF TERMINAL MONUMENT

SASKATCHEWAN, MANITOBA AND NORTHWEST TERRITORIES SURVEYS

On April 5, 1962, Mr. Boutilier terminated his survey at the intersection of the boundary with the south boundary of the Northwest Territories and on the following day, April 6, the terminal monument was constructed. Events leading up to the establishment of this monument are briefly as follows:

When the survey of the Saskatchewan-Northwest Territories boundary reached the estimated position of the northeast corner of Saskatchewan at the end of March 1958, the northerly portion of the boundary between Manitoba and Saskatchewan had not been surveyed and it was therefore not possible to determine and mark the true position of the corner.

W. V. Blackie, D.L.S., the surveyor in charge of that survey, had been instructed by the Saskatchewan-Northwest Territories Boundary Commission to terminate his survey a safe distance short of the estimated position of the corner. Mr. Blackie therefore placed the final monument on his survey, Monument 191, approximately 10 chains west of the estimated position of the corner.

In the following winter, 1958-59, the Manitoba-Northwest Territories Boundary Commission continued the survey of the 60th parallel of latitude easterly to mark the boundary between Manitoba and the Northwest Territories. The surveyor in charge of that survey, A. C. Roberts, M.L.S., was instructed to commence his survey at Monument 191 and to place the first monument on his survey approximately half a mile east of Monument 191. Monument 1 on Mr. Roberts' survey was therefore placed approximately 30 chains east of the estimated position of the corner.

It had been agreed by the respective Commissions that the corner common to the two provinces should lie on the straight line joining these two monuments, and that it should be monumented by the Manitoba-Saskatchewan Boundary Commission when completing the survey of the northerly portion of the boundary between the provinces.

Accordingly, acting under instructions from the Manitoba-Saskatchewan Boundary Commission, Mr. Boutilier constructed the terminal monument at the intersection of the Manitoba-Saskatchewan boundary with the straight line joining the above-mentioned monuments, namely, 191 and 1. Measurements and check measurements were then made from the terminal monument to Monuments 191 and 1 and angular measurements were made between the Manitoba-Saskatchewan

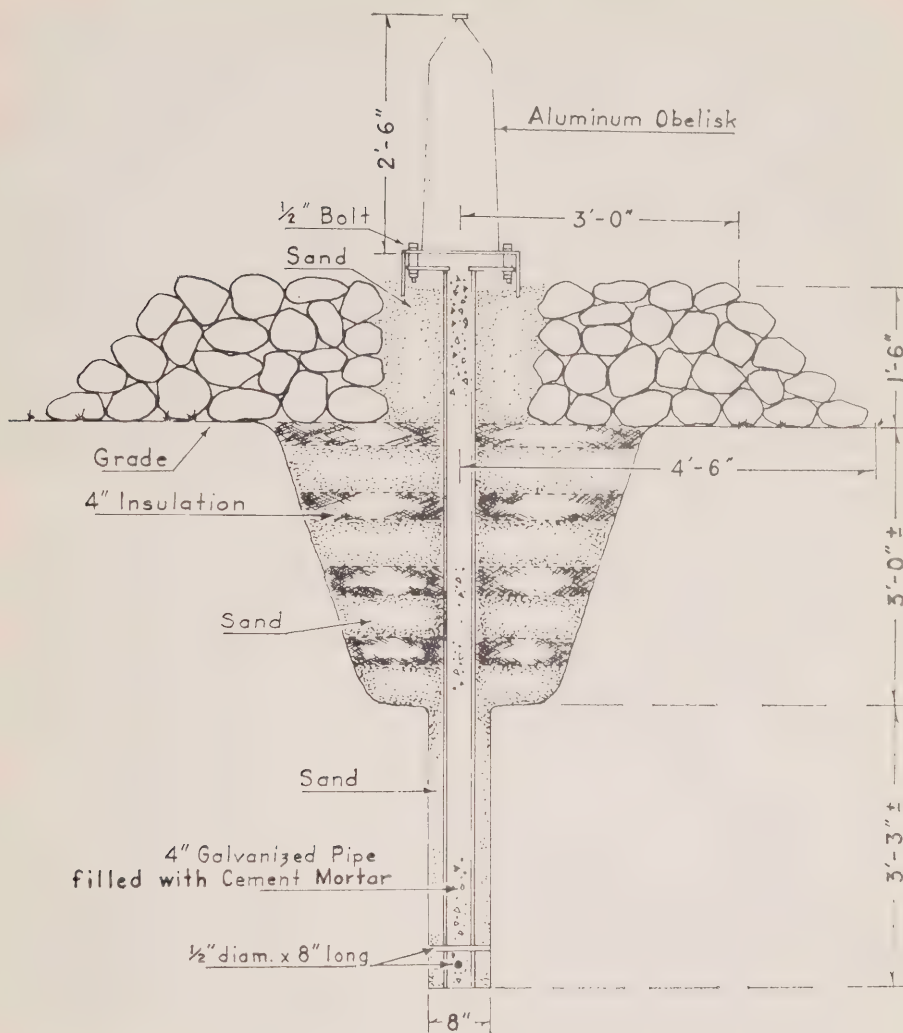


Diagram showing terminal monument (Monument 157)

boundary and the south boundary of the Northwest Territories. Levels and check levels were also run to the nearest bench marks east and west on the Northwest Territories boundary.

Description of Terminal Monument

Realizing that three Boundary Commissions were interested in the establishment of the terminal monument and that the common corner was one of considerable importance on the federal and provincial boundary surveys, the Commission, at a meeting on August 4, 1961, decided that a special type of monument should be erected at the common corner. After investigation the Commission finally decided on an aluminum monument. A design was submitted to the Aluminum Company of Canada Limited, and with the assistance of that Company, an aluminum obelisk was made and presented to the Commission.

The obelisk is $2\frac{1}{2}$ ft high and 10 in. square at the base. A 3-in.-diameter aluminum cap is welded to the top for the required chisel markings.

The column is made of $\frac{3}{16}$ -in. sheet aluminum and the base or bottom plate welded to it, consists of $\frac{3}{8}$ -in. plate aluminum.

The following words are sandblasted on the four sides of the obelisk: MANITOBA, SASKATCHEWAN, NORTHWEST TERRITORIES, and MANITOBA-SASKATCHEWAN BOUNDARY COMMISSION 1962, respectively.

The obelisk is hollow and the bottom plate has a port hole through which material of historic interest may be inserted. The port hole has been fitted with a cover plate and rubber gasket as a moisture seal and is closed by means of six aluminum bolts.

At the time of erecting the monument Mr. Boutilier placed inside it a glass jar containing papers bearing the signatures of all members of the survey party, a short description of the two seasons' survey operations, date of erection of the monument and some additional pertinent information.

The placing of this monument represented the completion not only of the current survey and those of the northern boundaries of Manitoba and Saskatchewan, but also of the survey of the whole sixtieth parallel boundary from the mountains of Alaska to Hudson Bay. To mark the occasion, a ceremony was held on August 15, 1963, at the site of the monument. On this occasion representatives of the Government of Canada and of the provincial Governments of Manitoba and Saskatchewan deposited in the obelisk various objects and letters addressed to government officers in the year 2063, when it is intended that the monument be opened.

Erection of Monument

The Commission had given a good deal of consideration to the matter of providing a stable footing for the monument, as soil and subsoil conditions, the presence of permafrost and other factors would not be known prior to erection of the monument.

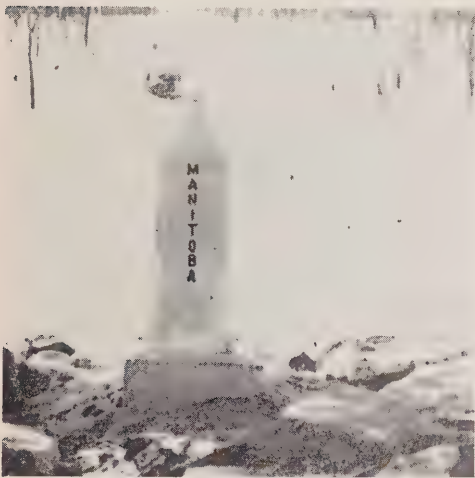
The footing decided on was composed of a 4-in.-diameter, grout-filled galvanized iron pipe, 8 ft long, with a 14-in.-square steel plate welded to its upper



Placing footing for terminal monument



Terminal monument before rock mound was built



Terminal monument viewed from the east



Terminal monument viewed from the west.
L. E. Boutillier stands beside the monument

end. This pipe was set into the ground to a depth of 6 ft 3 in. and was anchored at its lower end by two steel rods, 8 in. long, placed through holes in the pipe. The obelisk was then securely bolted on to the steel plate at the upper end of the pipe and placed in correct position.

Great care was exercised in back-filling the hole around the pipe. Sand was used to within 3 ft of the ground surface and alternate layers of sand and Zonolite insulation were placed in the upper part. To complete the monument, there was erected around the pipe above ground surface, a boulder rock mound, 9 ft square at the base and 6 ft square at the top, the core of the mound adjoining the pipe consisting of sand and gravel so as to provide for uniform settlement and to avoid lateral pressure against the pipe.

CHAPTER V

VERIFICATION OF FIELD WORK

VISIT BY COMMISSIONERS

At a meeting on December 28, 1961, the Commissioners decided to visit the survey party while it was engaged on the survey of the boundary. It was felt that this visit would provide an opportunity for a random inspection of the monuments, line cutting and technical operations. It was also felt that this proposed inspection, together with comparisons provided by connections to the tellurometer traverse and to the shoran network at station "Boundary" and a thorough examination of the survey returns, would obviate the necessity for a specific field inspection at a later date.

On March 20, 1962, the federal and Manitoba Commissioners left Winnipeg on a regular Transair flight for Lynn Lake. They were joined by the Saskatchewan Commissioner at The Pas on the way to Lynn Lake. Here they boarded a Manitoba Government Air Service plane and went first to Brochet to pick up a labourer for the survey party. The flight continued to the north side of Reindeer Lake where the cleared boundary line was visible and this was followed northerly to the survey camp, which was about 32 miles south of the Northwest Territories boundary.

Mr. Boutilier, the party chief, had planned to move camp on the following day. While the members of the survey party were engaged on this move, the Commissioners inspected the surveyed boundary in the vicinity. They walked along the line to Monument 134, about one mile north of camp, then went south to Monument 133, about one mile south of camp. The nature and quality of the monuments were observed as well as the vista-clearing, line blazing, bearing trees and bench marks.

In the afternoon, while the new camp was being set up, the Commissioners and the party chief went by air to the estimated site of the terminal monument at the junction of the Manitoba-Saskatchewan and Saskatchewan-Manitoba-Northwest Territories Boundaries. The purpose of this reconnaissance was to determine the nature of the ground upon which the terminal monument would be built. After landing on Hasbala Lake, the party went on foot to the estimated site of the terminal monument and determined that the ground would be soft and wet but not flooded. After general discussion at the site, they returned to camp.

At supper that evening, the Chairman of the Commission commended the members of the survey party for the strenuous efforts they were obviously making to complete the project.

Later some time was spent in a cursory review of the field notes that had been made by various party members and some features of these were discussed with Mr. Boutilier.

The following day was stormy and the heavy snowfall prevented any flying operations. The Commissioners, meanwhile, waited for the weather to clear so as to return to Lynn Lake and discussed various aspects of the work and particular questions raised by Mr. Boutilier.

The following day being fairly clear and considerably colder, the survey party resumed its work and the Commissioners left camp by air for Lynn Lake. The return trip provided another opportunity for a general inspection of the boundary vista and the terrain traversed.

As a result of their inspection the Commissioners made the following observations on the work of the survey party:

Monuments

Monuments 133 and 134 each comprised a short standard post cemented into rock accompanied by a normal sized stone mound built of shattered rock blasted out of nearby rock outcrop, and in each case two bearing trees. Unless deliberately scattered or taken away by human agencies, these mounds should constitute easily identifiable landmarks indefinitely. The thought occurred that the "quarries" where the mound material had been blasted from nearby rock outcrop would also have formed good permanent landmarks if their positions had been recorded during the course of the survey.

Bench Marks

A bench mark, consisting of a spike driven in a blazed tree, was observed at each of the two monuments. It was noted that the spikes were driven in a slightly downward direction rather than horizontally, probably as a result of trying to locate the spike as low on the tree as possible with respect to the snow surface. In view of the depth of snow, these will generally be situated about three feet above ground and the tree stumps will probably be from three to four feet high.

Boundary Vista

The tree growth along the line is fairly sparse. Line clearing was, therefore, not difficult and the boundary vista is well cleared.

Blazing

This was judged to be somewhat sparse and there had been some carelessness in not selecting the most appropriate trees for blazing, in places. This is probably a result of the hindrance presented by the very deep snow (3 to 4 feet).

Progress

The general progress of the party was considered to be very good. Despite very deep snow and extremely cold weather through January and February, average progress per calendar day had amounted to nearly $1\frac{1}{2}$ miles of boundary surveyed.

Party Morale

This appeared to be very good. The men seemed to be in good condition and spirits and anxious to complete the job.

EXAMINATION OF SURVEY RECORDS

To ensure that Mr. Boutilier had followed his instructions for the survey and that clerical and other errors were eliminated, an examiner was appointed by the Commission to examine the returns of survey submitted by Mr. Boutilier at the end of each of his two field seasons.

John Carroll, D.L.S., who had made several examinations of a similar nature in the past, was appointed by the Commission to undertake this work.

Mr. Carroll was asked to make a complete examination of all the returns and particularly to draw to the attention of the Commission any failure on the part of Mr. Boutilier to follow the instructions.

Very thorough examinations of both sets of survey returns were made by Mr. Carroll and his findings were stated in two reports submitted to the Commission.

In the light of Mr. Carroll's reports, Mr. Boutilier reviewed his returns, investigated any indicated discrepancies or errors and put them in final form.

RANDOM COMPARISONS

The Topographical Survey of the Department of Mines and Technical Surveys had made a tellurometer traverse in the vicinity of the boundary and a number of the traverse stations were tied in by Mr. Boutilier. The results of the closures were as follows:

Plug 3 (22nd base line)	to	Station A-86	1 in 16,000,
A-86	to	A-85	1 in 15,000,
A-85	to	A-83	1 in 25,000,
A-83	to	Boundary shoran	1 in 3,000,
Boundary shoran	to	A-49	1 in 2,200,
A-49	to	A-45	1 in 3,200,
A-45	to	A-18	1 in 5,700,
A-18	to	A-16	1 in 4,300.

The poor closures shown for the last five sections listed above are probably due to weakness of the tellurometer traverse. This explanation is supported by the following over-all closures which test all the boundary dimensions from station A-83 to A-16:

The closure from N.E. Cor. sec. 36, township 84, 1W2, to Monument 64 is 1 in 13,250, as computed from ties to "Boundary" shoran and from Topographical Survey ties to "Lynn" shoran.

The closure from Monument 64 to Monument 141 on the Saskatchewan-Northwest Territories Boundary (approximately 78 miles west of aluminum obelisk) is 1 in 15,000 based on Geodetic Survey values for "Boundary" and "Black".

The closure from Monument 64 to Monument 54 on the Manitoba-Northwest Territories Boundary (approximately 67.6 miles east of aluminum obelisk) is 1 in 12,200, based on shoran values for stations "Boundary" and "Nueltin".

CHAPTER VI

CONCLUSION AND RECOMMENDATIONS

SUMMARY OF SURVEY RESULTS

The unsurveyed second meridian portion of this boundary has now been completed, having been surveyed a distance of 253.8 miles during two winter seasons. The survey was started at the 22nd base line and finished at the south boundary of the Northwest Territories.

On this portion of the boundary, 157 monuments were erected, all being inter-visible. The average interval between monuments is just over $1\frac{1}{2}$ miles. The maximum distance between any two monuments is 805.7624 chains—viz. between Monuments 66 and 67 (Reindeer Lake)—and the minimum distance is 11.9058 chains between Monuments 92 and 93.

Of the 157 monuments erected, 144 consisted of short survey posts cemented into rock and referenced by stone mounds, 12 consisted of short survey posts cemented into iron pipes, 8 of which were referenced by stone mounds and 4 by earth mounds and 4 pits. The special monument erected at the north end of the boundary is described in Chapter IV. The monuments are all well constructed and should provide good evidence of the position of the boundary for a very long time.

The well cleared line and the blazed trees should also provide evidence of the position of the boundary for many years, except where the line passed through fire-killed timber, which, when blown down, will leave only the stumps as evidence.

The distances between monuments and the azimuths of the straight lines joining successive monuments have been carefully determined to show the relationship of each to its neighbours.

The atlas which accompanies and forms part of this report comprises 15 map sheets. It forms a complete description of the portion of the boundary surveyed. Each sheet covers 15 minutes of latitude or about $17\frac{1}{2}$ miles of the boundary.

The sheets in the atlas are numbered in sequence from 30A to 44 to allow the whole Manitoba-Saskatchewan boundary to be covered eventually in a uniform series of sheets numbered from 1 to 44 with Sheet 1 starting at the International boundary with the United States.

On each map sheet in the atlas the position and nature of each boundary monument is shown, together with adjacent topographic detail. The topographic detail has been derived from the observations of the surveyor on the ground, supplemented by aerial photographs. In this way, the physical position of the boundary with relation to the natural features can be readily recognized.

The ground profile of the portion of the boundary surveyed is also shown on the map sheets to provide an appreciation of the nature of the terrain traversed by the boundary.

The spheroidal position of the boundary as shown on the map sheets is approximate and is derived from the geodetic station on Boundary Island in Reindeer Lake.

RECOMMENDATIONS

The Commission is satisfied that the surveys performed during the winters of 1960-61 and 1961-62 constitute adequate demarcation of the portion of the boundary surveyed and considers that it should be confirmed by appropriate legislation.

The Commission therefore recommends that:

1. The portion of the boundary between the Provinces of Manitoba and Saskatchewan as defined on the ground by the Commission in the years 1961 and 1962, as shown on atlas map sheets 30A to 44 inclusive and signed by the three Commissioners, be accepted throughout its surveyed length as part of the true interprovincial boundary.
2. The Legislatures of the Provinces of Manitoba and Saskatchewan consent to declaration by the Parliament of Canada that the above-described portion of the boundary is part of the true boundary between the Provinces of Manitoba and Saskatchewan, and
3. The Parliament of Canada so declare.

It is obvious that no matter how well a line is marked on the ground, the original markings will eventually disappear due to natural overgrowth, decay or to actual physical damage. Realizing the importance of preserving these markings, the Commission feels that provision should be made now for the preservation and restoration of the boundary markings. For this reason the Commission further recommends that:

4. The functions of the present Boundary Commission be extended to include the execution of such re-surveys, line clearing and restoration or other work as may be necessary from time to time to maintain the present boundary vista and monuments in a good state of preservation,
5. The costs involved in the foregoing extended functions be shared equally between the Governments of Manitoba and Saskatchewan.

DISPOSITION OF SURVEY RECORDS

The surveyor's reports and the original records of his surveys have all been filed in the Surveys Branch of the Department of Mines and Natural Resources at Winnipeg.

ACKNOWLEDGMENTS

The Commission wishes to record its appreciation to the Manitoba Government Air Service, the Aluminum Company of Canada Limited, and other government and private agencies for their help and the many courtesies extended to the survey party.

The Commission also extends its thanks to the Geodetic Survey of Canada and the Topographical Survey, both of the Department of Mines and Technical Surveys for their help in providing field checks on certain of the boundary dimensions.

Appendix I—Monument Data

APPENDIX I

SUMMARY OF MONUMENT DATA

Monument No.	Description	Azimuth (to North)	Distance from last Monument	Total Distance from 22nd Base Line		Elevations in Feet
				Miles	Chains	
N.E. 36-84-1 W2	P. in Rock S.M.	0°00'12"		0	00.0000	1180.05
1	P. in Rock S.M.	0°00'07"	72.6129	0	72.6129	1207.87
2	P. in Rock S.M.	0°00'02"	74.3834	1	66.9963	1199.06
3	P. in Rock S.M.	359°59'59"	95.0923	3	02.0886	1282.57
4	P. in Rock S.M.	359°59'58"	133.0354	4	55.1240	1227.73
5	P. in Rock S.M.	359°59'58"	105.9388	6	01.0628	1265.89
6	P. in Rock S.M.	359°59'59"	42.3812	6	43.4440	1305.23
7	P. in Rock S.M.	359°59'53"	125.8898	8	09.3338	1277.22
8	P. in Rock S.M.	359°59'46"	122.6475	9	51.9813	1243.25
9	P. in Rock S.M.	359°59'46"	135.8531	11	27.8344	1289.00
10	P. in Rock S.M.	359°59'49"	214.3539	14	02.1883	1206.70
11	P. in Rock S.M.	0°00'02"	128.9077	15	51.0960	1173.20
12	P. in Rock S.M.	0°00'02"	124.5468	17	15.6428	1286.45
13	P. in Rock S.M.	0°00'12"	70.9836	18	06.6264	1253.31
14	P. in Rock S.M.	0°00'02"	147.4579	19	74.0843	1200.75
15	P. in Rock S.M.	0°00'02"	42.1743	20	36.2586	1240.47
16	P. in Rock S.M.	0°00'14"	73.1692	21	29.4278	1268.11
17	P. in Rock S.M.	0°00'14"	105.6566	22	55.0844	1308.54
18	P. in Rock S.M.	359°59'56"	123.1881	24	18.2725	1315.45
19	P. in Rock S.M.	359°59'56"	69.3612	25	07.6337	1345.94
20	P. in Rock S.M.	359°59'59"	88.2539	26	15.8876	1352.97
21	P. in Rock S.M.	359°59'57"	33.3655	26	49.2531	1326.84
22	P. in Rock S.M.	359°59'57"	151.2315	28	40.4846	1250.06
23	P. in Rock S.M.	359°59'54"	93.3824	29	53.8670	1289.92
24	P. in Rock S.M.	359°59'52"	79.6804	30	53.5474	1324.21
25	P. in Rock S.M.	359°59'53"	104.1741	31	77.7215	1353.43
26	P. in Rock S.M.	359°59'54"	133.0593	33	50.7808	1317.47
27	P. in Rock S.M.	359°59'56"	176.3177	35	67.0985	1279.79
28	P. in Rock S.M.	359°59'57"	118.5217	37	25.6202	1161.32
29	P. in Rock S.M.	359°59'57"	112.6267	38	58.2469	1203.76
30	P. in Rock S.M.	359°59'57"	37.2177	39	15.4646	1238.51
31	P. in Rock S.M.	359°59'56"	73.2205	40	08.6851	1243.00
32	P. in Rock S.M.	359°59'59"	102.9415	41	31.6266	1232.83
33	P. in Rock S.M.	359°59'55"	134.0542	43	05.6808	1197.24
34	P. in Rock S.M.	359°59'51"	50.0358	43	55.7166	1202.40
35	P. in Rock S.M.	359°59'57"	92.5875	44	68.3041	1182.72
36	P. in Rock S.M.	359°59'57"	130.0741	46	38.3782	1177.20
37	P. in Rock S.M.	359°59'57"	77.6495	47	36.0277	1219.10
38	P. in Rock S.M.	359°59'51"	57.0608	48	13.0885	*

Monument No.	Description	Azimuth (to North)	Distance from last Monument	Total Distance from 22nd Base Line		Elevations in Feet
				Miles	Chains	
39	P. in Rock S.M.	359°59'50''	159.9750	50	13.0635	1284.57
40	P. in Pipe S.M.	359°59'49''	170.0556	52	23.1191	1177.52
41	P. in Rock S.M.	359°59'48''	62.7504	53	05.8695	1218.64
42	P. in Rock S.M.	359°59'47''	36.6570	53	42.5265	1231.10
43	P. in Rock S.M.	359°59'47''	109.4670	54	71.9935	1195.25
44	P. in Rock S.M.	359°59'47''	51.8703	55	43.8638	1200.17
45	P. in Rock S.M.	359°59'58''	178.2616	57	62.1254	1188.60
46	P. in Pipe S.M.	359°59'56''	105.9777	59	08.1031	1214.45
47	P. in Rock S.M.	359°59'56''	226.6422	61	74.7453	1146.16
48	P. in Rock S.M.	359°59'56''	21.7061	62	16.4514	1157.07
49	P. in Rock S.M.	359°59'56''	192.9717	64	49.4231	1166.94
50	P. in Rock S.M.	0°00'04''	38.3810	65	07.8041	1176.89
51	P. in Rock S.M.	0°00'03''	127.2066	66	55.0107	1199.15
52	P. in Rock S.M.	0°00'03''	102.4399	67	77.4506	1142.99
53	P. in Rock S.M.	0°00'02''	165.8379	70	03.2885	1219.72
54	P. in Rock S.M.	0°00'02''	71.7703	70	75.0588	1208.61
55	P. in Rock S.M.	0°00'06''	157.7988	72	72.8576	1141.77
56	P. in Rock S.M.	0°00'10''	83.1121	73	75.9697	1154.36
57	P. in Rock S.M.	0°00'13''	126.9005	75	42.8702	1192.33
58	P. in Rock S.M.	0°00'04''	64.7409	76	27.6111	1179.95
59	P. in Rock S.M.	0°00'04''	87.4676	77	35.0787	1189.80
60	P. in Rock S.M.	0°00'02''	125.7709	79	00.8496	1186.15
61	P. in Rock S.M.	359°59'58''	119.2904	80	40.1400	1150.83
62	P. in Rock S.M.	359°59'49''	744.5057	89	64.6457	1122.04
63	P. in Rock S.M.	359°59'56''	101.4926	91	06.1383	1122.95
64	P. in Rock S.M.	0°00'00''	147.1327	92	73.2710	1122.40
65	P. in Rock S.M.	0°00'03''	192.2670	95	25.5380	1119.77
66	P. in Rock S.M.	0°00'07''	52.8837	95	78.4217	1117.24
67	P. in Rock S.M.	0°00'02''	805.7624	106	04.1841	1115.39
68	P. in Rock S.M.	359°59'56''	141.2267	107	65.4108	1153.22
69	P. in Rock S.M.	359°59'49''	331.6710	111	77.0818	1112.36
70	P. in Rock S.M.	359°59'42''	215.9059	114	52.9877	1211.20
71	P. in Rock S.M.	359°59'42''	187.5586	117	00.5463	1153.89
72	P. in Rock S.M.	0°00'00''	103.5323	118	24.0786	1110.62
73	P. in Rock S.M.	0°00'04''	360.0503	122	64.1289	1147.31
74	P. in Rock S.M.	0°00'04''	143.8876	124	48.0165	1184.54
75	P. in Rock S.M.	0°00'04''	60.9106	125	28.9271	1202.04
76	P. in Rock S.M.	0°00'04''	228.9433	128	17.8704	*
77	P. in Rock S.M.	0°00'03''	109.6640	129	47.5344	1338.93
78	P. in Rock S.M.	0°00'03''	88.6717	130	56.2061	1335.37
79	P. in Rock S.M.	0°00'04''	222.0435	133	38.2496	1381.59
80	P. in Rock S.M.	0°00'06''	26.0569	133	64.3065	1439.57
81	P. in Rock S.M.	0°00'08''	103.7958	135	08.1023	1404.45
82	P. in Rock S.M.	0°00'09''	88.6056	136	16.7079	1430.92
83	P. in Rock S.M.	0°00'00''	131.8118	137	68.5197	1355.15
84	P. in Rock S.M.	0°00'00''	221.9063	140	50.4260	1326.05
85	P. in Rock S.M.	359°59'57''	66.7303	141	37.1563	1372.33
86	P. in Rock S.M.	359°59'51''	19.1896	141	56.3459	1373.36

Monument No.	Description	Azimuth (to North)	Distance from last Monument	Total Distance from 22nd Base Line		Elevations in Feet
				Miles	Chains	
87	P. in Rock S.M.	359°59'48''	102.6471	142	78.9930	1328.04
88	P. in Rock S.M.	359°59'45''	101.1979	144	20.1909	1354.65
89	P. in Rock S.M.	359°59'55''	94.7347	145	34.9256	1294.82
90	P. in Rock S.M.	359°59'51''	148.1763	147	23.1019	1564.82
91	P. in Pipe S.M.	359°59'47''	152.9528	149	16.0547	1288.10
92	P. in Rock S.M.	359°59'40''	110.1786	150	46.2333	1647.01
93	P. in Rock S.M.	359°59'36''	11.9058	150	58.1391	1669.61
94	P. in Pipe S.M.	359°59'35''	334.1397	154	72.2788	1216.60
95	P. in Pipe S.M.	0°00'03''	82.5937	155	74.8725	1223.95
96	P. in Rock S.M.	0°00'03''	132.9241	157	47.7966	1222.84
97	P. in Pipe, Pits & M	0°00'06''	73.3008	158	41.0974	1260.32
98	P. in Pipe, Pits & M	0°00'05''	71.6186	159	32.7160	1259.76
99	P. in Pipe S.M.	0°00'12''	109.4956	160	62.2116	1241.04
100	P. in Rock S.M.	0°00'07''	114.0915	162	16.3031	1219.16
101	P. in Rock S.M.	359°59'59''	161.5465	164	17.8496	1260.50
102	P. in Pipe, Pits & M	359°59'57''	199.7024	166	57.5520	1208.40
103	P. in Rock S.M.	359°59'59''	144.7682	168	42.3202	1316.86
104	P. in Rock S.M.	0°00'07''	93.6502	169	55.9704	1356.80
105	P. in Rock S.M.	0°00'04''	109.9191	171	05.8895	1371.22
106	P. in Pipe, Pits & M	0°00'02''	99.7009	172	25.5904	1349.60
107	P. in Pipe S.M.	0°00'02''	231.0127	175	16.6031	1234.52
108	P. in Rock S.M.	0°00'16''	145.0475	177	01.6506	1255.12
109	P. in Rock S.M.	0°00'30''	109.8812	178	31.5318	1287.79
110	P. in Rock S.M.	0°00'07''	165.3735	180	36.9053	1297.40
111	P. in Rock S.M.	0°00'00''	126.7383	182	03.6436	1267.23
112	P. in Rock S.M.	359°59'53''	80.8880	183	04.5316	1257.56
113	P. in Rock S.M.	359°59'47''	154.5247	184	79.0563	1288.21
114	P. in Rock S.M.	359°59'47''	209.2532	187	48.3095	1300.05
115	P. in Rock S.M.	359°59'47''	81.7764	188	50.0859	1380.89
116	P. in Rock S.M.	359°59'59''	96.6493	189	66.7352	1412.05
117	P. in Rock S.M.	0°00'08''	95.8865	191	02.6217	1436.29
118	P. in Rock S.M.	0°00'07''	177.6650	193	20.2867	1443.47
119	P. in Rock S.M.	0°00'05''	41.3374	193	61.6241	1424.12
120	P. in Rock S.M.	0°00'05''	173.5597	195	75.1838	1352.54
121	P. in Rock S.M.	0°00'05''	166.8396	198	02.0234	1338.96
122	P. in Rock S.M.	0°00'05''	60.1923	198	62.2157	1348.78
123	P. in Rock S.M.	0°00'02''	102.2728	200	04.4885	1336.88
124	P. in Rock S.M.	359°59'59''	186.0131	202	30.5016	1361.77
125	P. in Rock S.M.	359°59'56''	138.4299	204	08.9315	1404.86
126	P. in Rock S.M.	359°59'56''	160.7643	206	09.6958	1412.51
127	P. in Rock S.M.	359°59'56''	190.4915	208	40.1873	1433.60
128	P. in Rock S.M.	0°00'05''	48.8055	209	08.9928	1467.59
129	P. in Rock S.M.	0°00'11''	63.2935	209	72.2863	1452.63
130	P. in Rock S.M.	0°00'08''	82.4402	210	74.7265	1399.25
131	P. in Rock S.M.	0°00'09''	164.3958	212	79.1223	1567.16
132	P. in Rock S.M.	0°00'10''	91.0614	214	10.1837	1514.82
133	P. in Rock S.M.	0°00'06''	84.8206	215	15.0043	1455.61
134	P. in Rock S.M.	0°00'12''	132.3926	216	67.3969	1381.07
135	P. in Rock S.M.	0°00'20''	123.4951	218	30.8920	1391.25

Monument No.	Description	Azimuth (to North)	Distance from last Monument	Total Distance from 22nd Base Line		Elevations in Feet
				Miles	Chains	
136	P. in Rock S.M.	0°00'05''	190.1390	220	61.0310	1391.26
137	P. in Rock S.M.	0°00'03''	104.1542	222	05.1852	1401.52
138	P. in Rock S.M.	0°00'00''	115.8866	223	41.0718	1436.19
139	P. in Rock S.M.	0°00'00''	71.9875	224	33.0593	1403.36
140	P. in Rock S.M.	0°00'01''	154.4411	226	27.5004	1417.12
141	P. in Rock S.M.	0°00'02''	93.8411	227	41.3415	1457.09
142	P. in Rock S.M.	0°00'04''	66.0374	228	27.3789	1448.60
143	P. in Rock S.M.	0°00'05''	99.8134	229	47.1923	1401.04
144	P. in Rock S.M.	0°00'07''	120.9395	231	08.1318	1404.33
145	P. in Rock S.M.	0°00'09''	67.8886	231	76.0204	1399.42
146	P. in Rock S.M.	0°00'09''	168.1694	234	04.1898	1313.29
147	P. in Rock S.M.	0°00'03''	140.5595	235	64.7493	1314.25
148	P. in Rock S.M.	0°00'00''	197.7808	238	22.5301	1406.58
149	P. in Rock S.M.	0°00'06''	144.0664	240	06.5965	1399.14
150	P. in Rock S.M.	0°00'12''	177.6130	242	24.2095	1384.51
151	P. in Rock S.M.	0°00'18''	63.7479	243	07.9574	1364.46
152	P. in Rock S.M.	0°00'25''	75.3453	244	03.3027	1279.31
153	P. in Rock S.M.	0°00'33''	165.7538	246	09.0565	1250.24
154	P. in Rock S.M.	0°00'18''	136.2229	247	65.2794	1196.65
155	P. in Rock S.M.	0°00'08''	77.1430	248	62.4224	1204.13
156	P. in Pipe S.M.	359°59'53''	320.2036	252	62.6260	1144.07
157	Aluminum Obelisk					
	Intersection with North Boundary		78.7782	253	61.4042	*

* no elevation taken.

APPENDIX II

DESCRIPTION OF TERRAIN

General

The country from the start of the survey at Kamuchawie Lake to the south shore of Reindeer Lake was the roughest portion of the more than 250 miles surveyed. It consisted of heavily rolling country with rock outcropping on most of the summits of the hills.

North of Reindeer Lake the boundary runs through rolling country with occasional high hills. One of these hills had a 400-ft steeply rising face on its south side and triangulation was necessary to measure over it. This hill, completely bare on top, is now recorded among the place names of Saskatchewan as 'Old Baldy'.

The boundary crossed a number of eskers, the most prominent being about midway between Waspison Lake and Cochrane River. It is about 100 ft high.

Forest Cover

The entire portion of boundary surveyed, except across water bodies, lay in forested country. The forest cover consisted mainly of black spruce, white spruce and jackpine, with occasional stands of poplar, birch and tamarac. Jackpine was plentiful south of Reindeer Lake, but very few were seen north of the lake.

Between Laurie Lake and Whitesand Bay of Reindeer Lake, the boundary passed over a 20-mile stretch of burnt-over country now covered with a new growth of jackpine 6 to 10 ft high. Large stretches of burnt-over country were found between Whiskey Jack Lake and Reindeer Lake, between Waspison Lake and the Cochrane River and around Hasbala Lake.

A distinct difference in tree growth was noticed north of Reindeer Lake. This lake appears to be on the dividing line between the merchantable timber to the south and the stunted unmerchantable trees to the north.

Game

During both seasons many herds of caribou were seen, as the boundary passed through their wintering grounds. Herds, numbering up to three hundred, were seen in the Cochrane River area, while small herds were seen on almost every lake in the vicinity.

Moose were seen between Kamuchawie Lake and Whiskey Jack Lake. The high hill, known as Old Baldy, seemed to be as far north as the moose browsed, although occasional tracks were seen near the north end of the boundary.

Fur-bearing animals did not appear to be plentiful, although during both seasons signs of mink, otter, beaver, muskrats, wolverine and lynx were noticed. A few wolves were noted chasing the caribou herds in the Waspison Lake area.

Ptarmigan were plentiful along the entire portion of the boundary.

During the first season a few trappers visited the camp, but none were met during the second season.

Fish.

A few lake trout and jackfish were caught in some of the lakes. The only commercial fishing operations noticed were on Reindeer Lake. There is a fish filleting plant at Kinoosao, a small settlement on the shore of the lake on the Saskatchewan side of the boundary.

APPENDIX III

SUMMARY OF PREVIOUS SURVEYS BY THE COMMISSION

1936 Survey

Shortly after the initial establishment of the Manitoba-Saskatchewan Boundary Commission on June 10, 1936, the Commissioners decided to survey a portion of the boundary at Flin Flon. R. A. McLellan, D.L.S., M.L.S., S.L.S., was engaged to make the survey which he commenced on August 2, 1936 and completed on November 10, 1936. The work involved a retracement of the east boundary of range 30 W.P.M. across townships 65, 66, 67 and 68, a survey of the east boundary of range 29 W.P.M. across these same townships, a survey of the north boundary of township 66, ranges 29, 30 and 31 W.P.M., and the survey of the actual inter-provincial boundary in the immediate vicinity of the Flin Flon mine. A total of 3.6 miles of actual boundary along the centre of the road allowance was marked by seven concrete piers.

A report on the survey was prepared in 1937 by the Commission and copies submitted to the Saskatchewan Minister of Natural Resources and to the Manitoba Minister of Mines and Natural Resources.

This portion of the boundary across townships 65, 66, 67 and 68 was confirmed by the Legislatures of both provinces. "The Manitoba-Saskatchewan Boundary Act 1937", 1 George VI, Chapter 5, was assented to in the Manitoba Legislature on April 17, 1937 and "The Manitoba-Saskatchewan Boundary Act 1937", 1 George VI, Chapter 96, was assented to in the Saskatchewan Legislature on April 16, 1937. This survey has not been ratified by the Parliament of Canada.

1941 Survey

The next portion of the boundary to be surveyed was in 1941 in the Porcupine forest reserve. Lumber companies were cutting timber in the reserve in the vicinity of the boundary and it was essential that the boundary be defined on the ground.

By this time, the Manitoba Commissioner, S. E. McColl, had died and the Commissioner for Saskatchewan, M. B. Weekes, had retired. By Manitoba Order in Council No. 469/40 dated April 24, 1940, H. E. Beresford was appointed Boundary Commissioner for Manitoba and by Saskatchewan Order in Council No. 493/41, dated May 12, 1941, D. A. Smith was appointed Boundary Commissioner for Saskatchewan.

These two gentlemen were appointed to the Commission by Dominion Order in Council, P.C. 5041 which confirmed the establishment of the Commission and re-appointed F. H. Peters as chairman.

The survey of a portion of the boundary in the Porcupine forest reserve was then made by F. C. Lamb, D.L.S., S.L.S., representing Saskatchewan, assisted

by E. Gauer, D.L.S., M.L.S., representing Manitoba. The work involved the survey and demarcation of the east boundary of range 30 W.P.M. across townships 41, 42 and 43 and a retracement survey of the east boundary of township 44, range 30 W.P.M., which had originally been surveyed in 1905. The centre of the road allowance was not monumented, the survey monuments being placed on the west boundary of the road allowance. The survey began on August 18, and was completed on October 11, 1941.

No report on this survey was made by the Commission. The portion of the boundary surveyed was approved and confirmed by legislation in both provinces, the Act in Manitoba being titled "The Manitoba-Saskatchewan Boundary Act, 1942", 5 and 6 George VI, Chapter 33, assented to on March 31, 1942 and that in Saskatchewan titled "The Manitoba-Saskatchewan Boundary Act, 1942", 6 George VI, Chapter 75, assented to on April 11, 1942.

The Parliament of Canada has not ratified this survey.

1947 Survey

Owing to expanding settlement and other developments along the Carrot River, the government of Manitoba found it necessary to subdivide township 54, range 29 W.P.M. To complete the survey of this township it was necessary to survey a portion of the range line between ranges 29 and 30 W.P.M., and the jog on the 14th correction line, which, in effect would establish a portion of the inter-provincial boundary. This was a matter which concerned the Commission and it was decided that it should direct that part of the survey that would define the boundary.

By this time, the Saskatchewan member of the Commission, D. A. Smith, had retired, and by Saskatchewan Order in Council No. 1783/47, dated November 21, 1947, A. I. Bereskin, D.L.S., S.L.S., was appointed to succeed him.

The Commission selected E. Gauer, D.L.S., M.L.S., to represent Manitoba and C. D. Brown, D.L.S., S.L.S., to represent Saskatchewan in carrying out the boundary survey. The survey was started on November 10, and was completed on November 18, 1947, during which period, three miles of the range line were retraced, the east boundary of section 36 in township 54, and the east boundary of section 1 in township 55, both in range 30 W.P.M., were surveyed, together with the jog on the 14th correction line. About four miles of the boundary were thus defined although the actual boundary was not monumented. Monuments were placed on the west side of the road allowance.

No report on this survey was prepared by the Commission and no legislation has been initiated confirming the survey of this portion of the boundary.

Before the plans of this survey were prepared for approval by the Commission, the Chairman, F. H. Peters retired. By Dominion Order in Council, P.C. 5933, dated December 23, 1948, B. W. Waugh, D.L.S., Surveyor General, was appointed chairman of the Commission in place of Mr. Peters.

No further surveys of the boundary were made until the recent survey of the second meridian portion in 1961 and 1962 which is the subject of this report.

APPENDIX IV

STATUS OF OTHER PORTIONS OF MANITOBA-SASKATCHEWAN BOUNDARY

A considerable amount of work remains to be done to complete the survey of the boundary between the two provinces. In 1881, when the legislators selected the centre of the road allowance between ranges 29 and 30, west of the principal meridian, as the western boundary of the province of Manitoba and which subsequently became a part of the eastern boundary of Saskatchewan, the range line (west boundary of the road allowance) had been surveyed under the Dominion Lands survey system across several townships, and further surveys of this range line were then being made.

By the time of the transfer of the natural resources to Manitoba in 1930, this range line had been surveyed continuously from the International boundary northerly to the north boundary of township 40 and at intervals as far north as the north boundary of township 68.

As outlined in Appendix III, the Commission has, since its appointment in 1936, made surveys of some of the unsurveyed portions.

Three portions of the range line still remain unsurveyed, viz. across townships 45 to 48 inclusive, across townships 58 to 60 inclusive, and across townships 69 to 82 inclusive. To complete the survey of these portions, it will be necessary to survey 126 miles of range lines and fix the jogs on 6 correction lines.

More than 80 years have elapsed since many parts of the range line between ranges 29 and 30 were surveyed and it is probable that many of the monuments placed during these and later surveys have disappeared. It is estimated that the monumentation governing 400 to 450 miles of this line is at least 45 years old. Although a few piecemeal retracement and restoration surveys have been made, a real need exists for a comprehensive retracement in order to preserve the ground position of the interprovincial boundary.

APPENDIX V
TYPICAL MONUMENTS



Monument 9—P. Rock S.M.



Monument 25—P. Rock S.M.



Monument 33—P. Rock S.M.

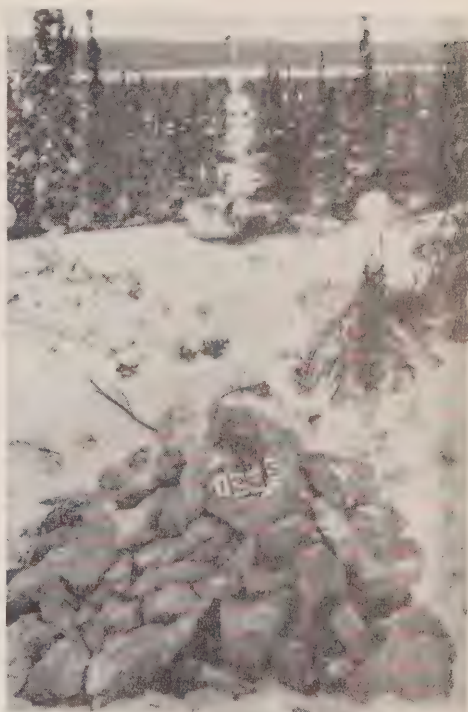


Monument 56—P. Rock S.M.

TYPICAL MONUMENTS



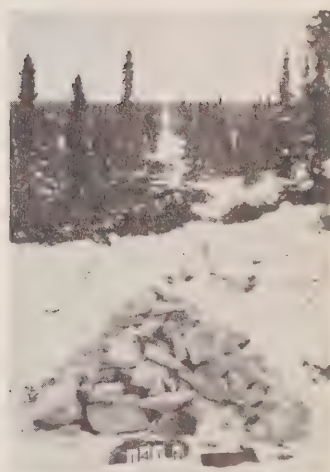
Monument 98—P. Pipe 4 Pits, M.



Monument 126—P. Rock S.M.



Monument 138—P. Rock S.M.



Monument 141—P. Rock S.M.

